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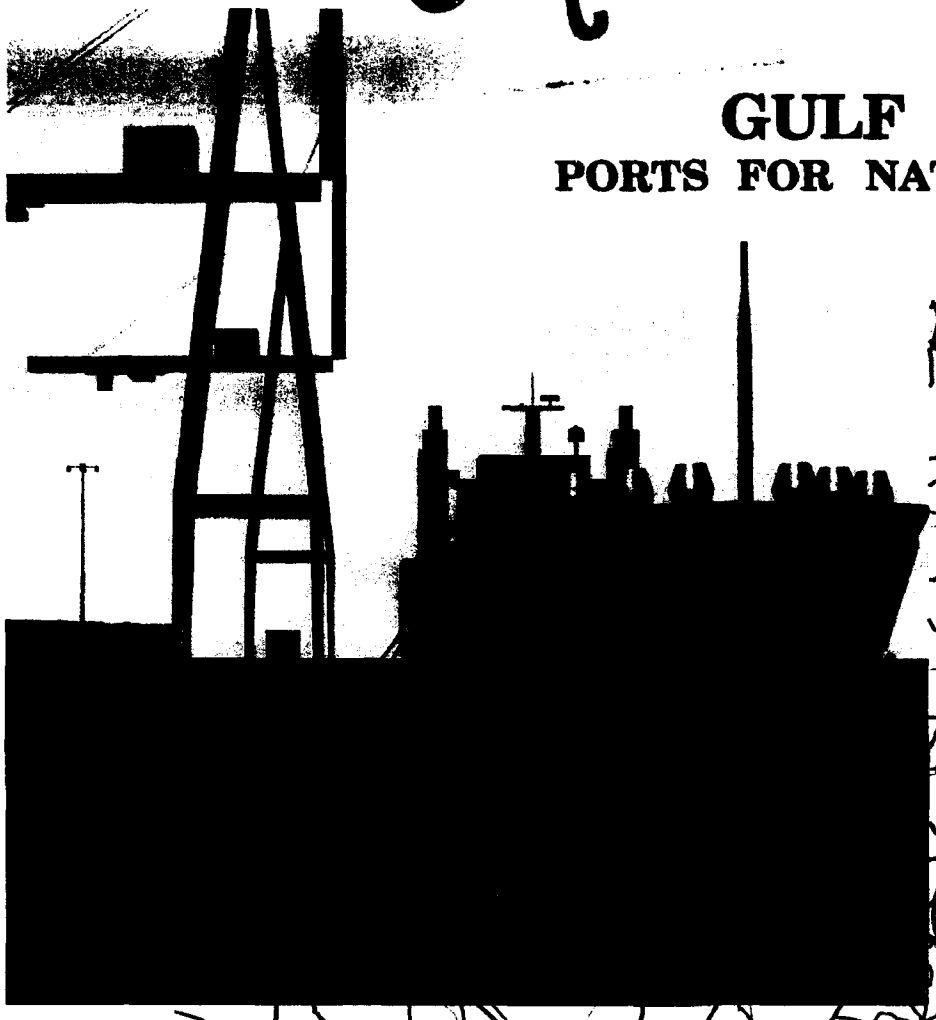
MTMCTEA Report SE 91-3d-31



GULF COAST
PORTS FOR NATIONAL DEFENSE

Military Traffic Management Command
Transportation Engineering Agency

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MILITARY TRAFFIC MANAGEMENT COMMAND
TRANSPORTATION ENGINEERING AGENCY

GULF COAST
PORTS FOR NATIONAL DEFENSE

PAUL BURGENER

A. GREY MARSH

SEPTEMBER 1993

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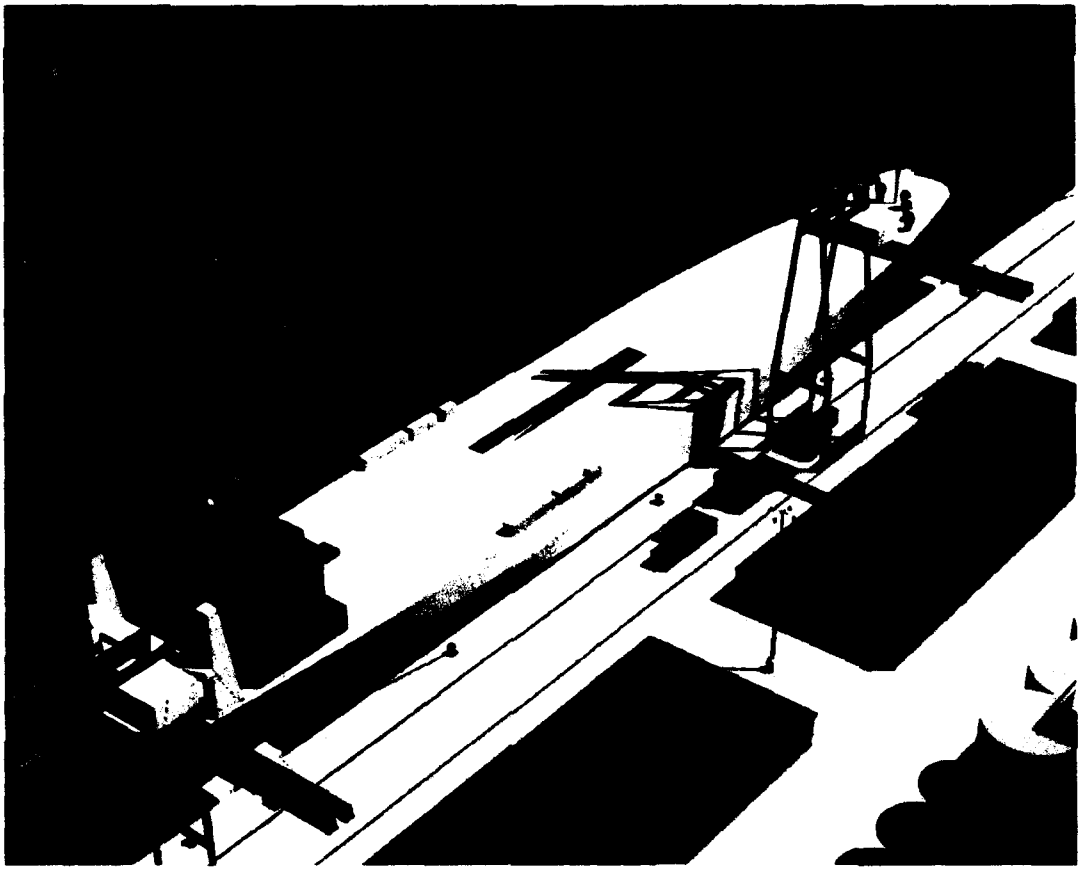
INTRODUCTION



As part of the ongoing Ports for National Defense (PND) Program, the Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) revised information for selected gulf coast ports. The objectives of this report are too:

- *Identify* the port facilities and equipment needed to support a deployment.
- *Determine* the port throughput capability in STON per day.
- *Determine* the ability of the MARAD designated facilities to meet the deployment of specific units.

PORT OF BEAUMONT

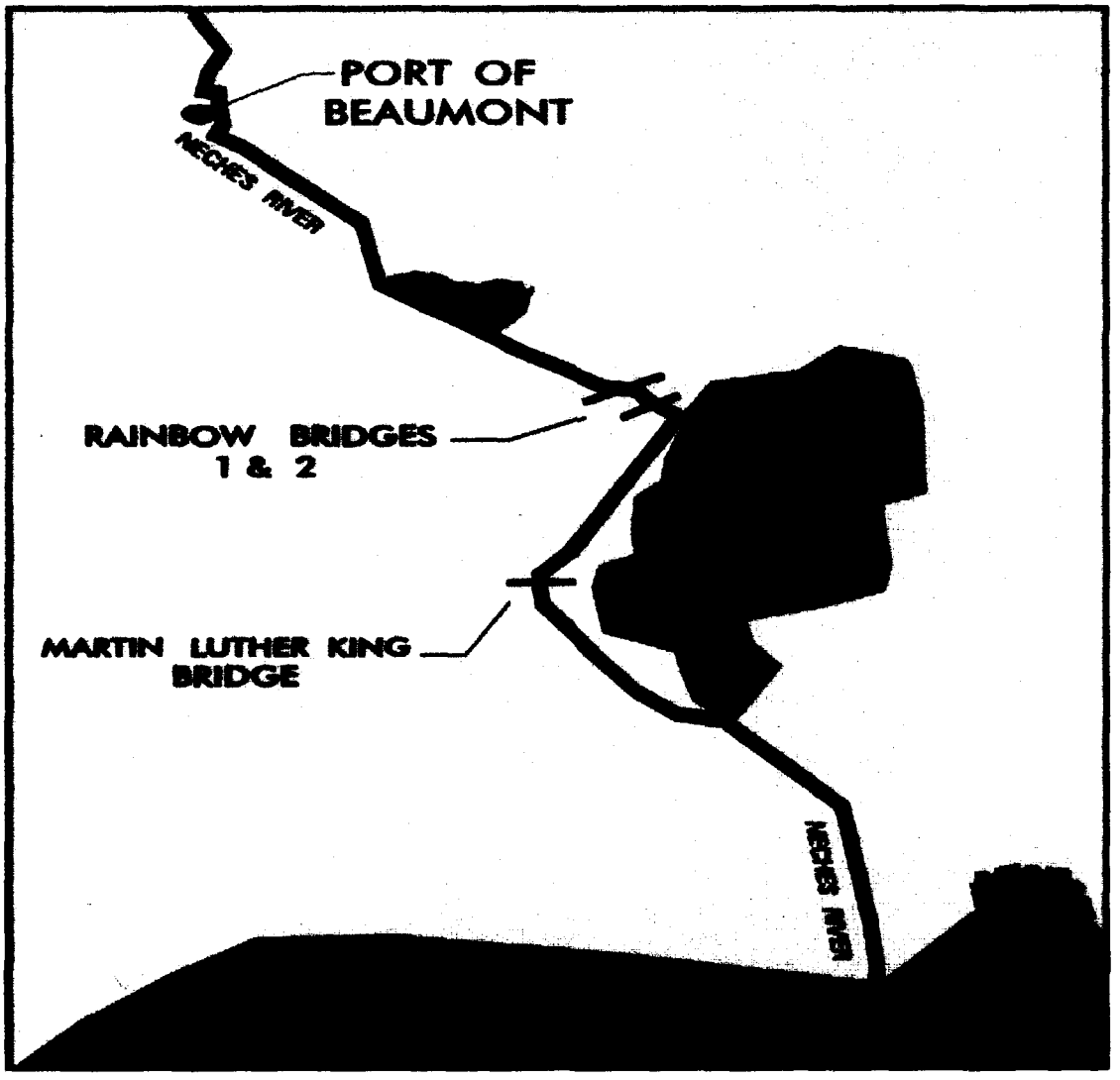
BEAUMONT, TEXAS

I. GENERAL DATA

TRANSPORTATION ACCESS

WATER

The Port of Beaumont, Texas, is about 80 miles east of Houston. It is on the Neches River, about 43 miles from the Gulf of Mexico. Entrance to the port is via the Sabine Pass, the Port Arthur and Sabine-Neches Canals, and the Neches River. The water depth of the channel and turning basin is 40 feet mean low water (MLW). The minimum channel width is 400 feet. The water depth for the Port of Beaumont ship berths ranges from 30 to 40 feet.



Water Access

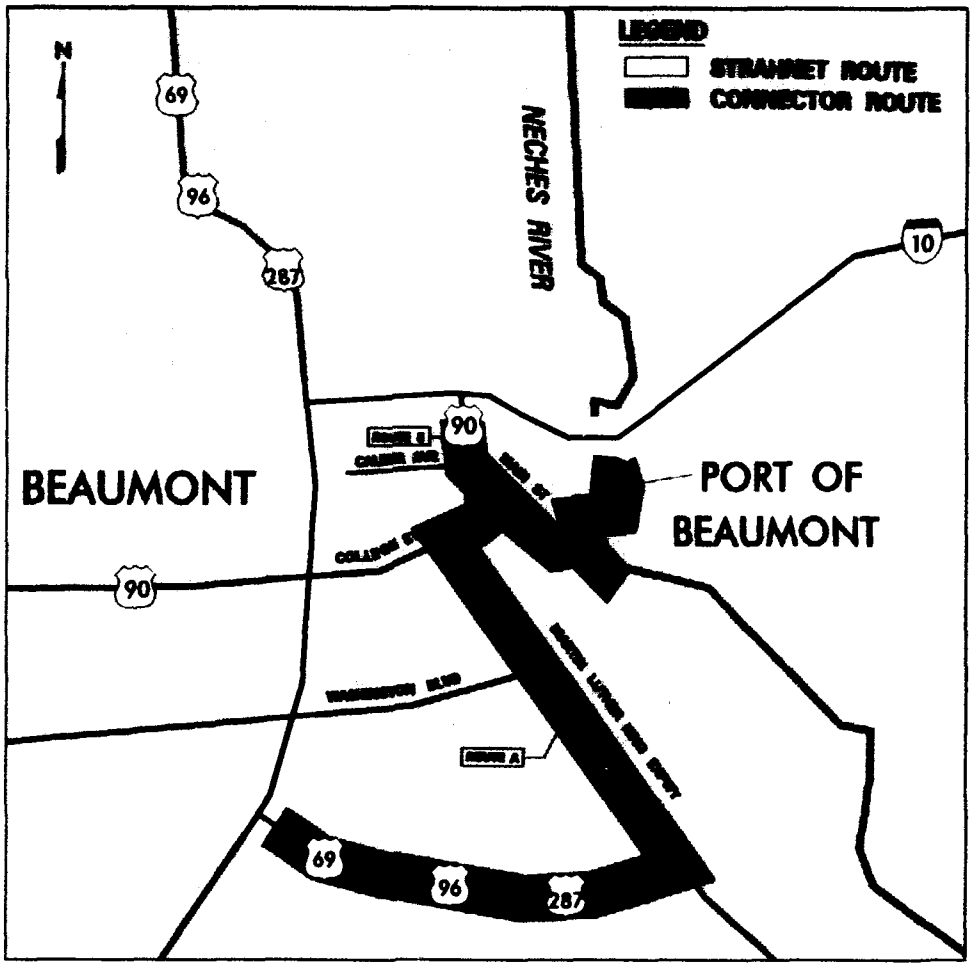
Three bridges cross the main shipping channels between the Gulf of Mexico and the Port of Beaumont. The first, on the Sabine-Neches Canal, is the Martin Luther King Memorial Bridge on Martin Luther King Boulevard, Texas Route 82. It has a horizontal clearance of 400 feet and a vertical clearance of 136 feet above mean high water (MHW).

The second bridge is next to the third bridge, along Texas 87. Both bridges span the Neches River, 18 miles downstream of the Port of Beaumont. The downstream bridge (Rainbow Bridge II) has a horizontal clearance of 400 feet and a vertical clearance of 143 feet above MHW. The upstream bridge (Rainbow Bridge I) has a horizontal clearance of 600 feet and a vertical clearance of 172 feet above MHW.

Besides the bridges, four power cables cross the Neches River. The authorized clearances for these cables are 164, 183, 164, and 187 feet.

HIGHWAY

A suitable network of highways serves the Port of Beaumont. The port has access to Interstate 10 and US Routes 69, 90, 96, and 287. Near Beaumont, US 287 and 96 run along US Route 69. Entrance to the port is off Main Street, about 1 mile from I-10/US 90. Main Street has some traffic congestion.



Highway Access

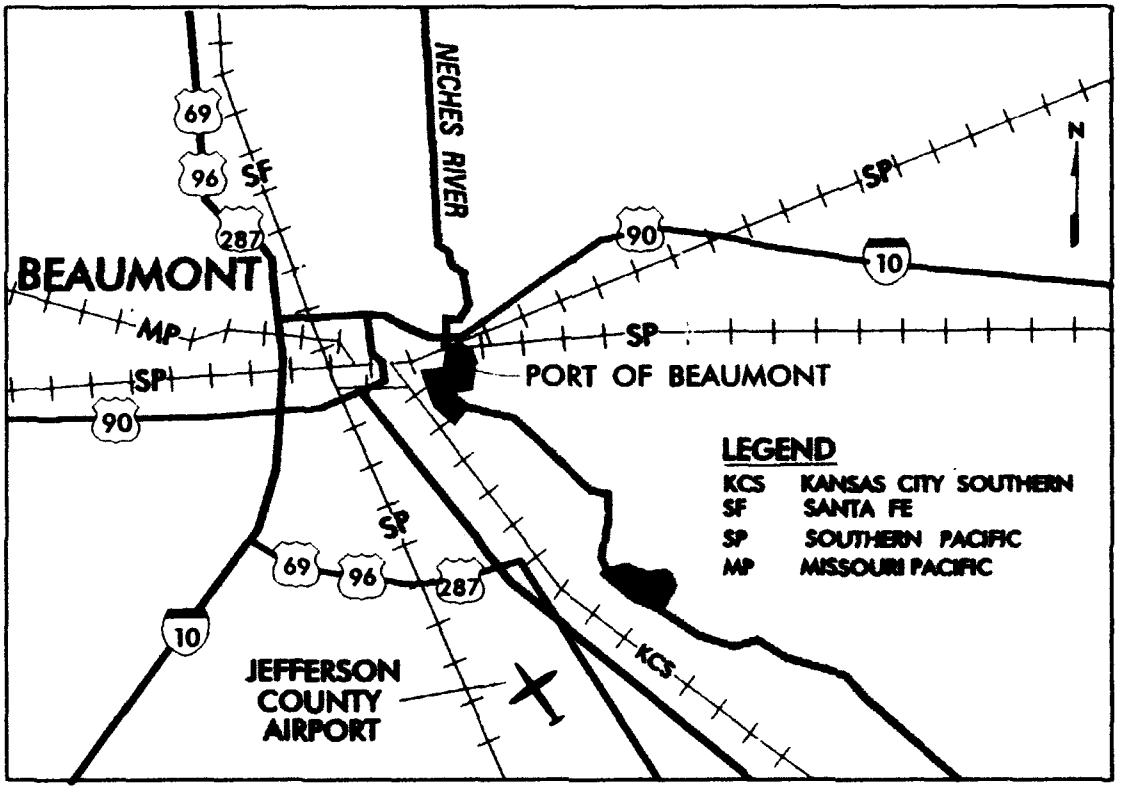
RAIL

Railroads serving Beaumont and the port are the Atchison, Topeka, and Santa Fe (ATSF); Kansas City Southern (KCS); Southern Pacific (SP); and Union Pacific (UP). Railyards within 2 miles of the port are the ATSF, KCS, and SP. Each of these railyards has a capacity of at least 278 89-foot railcars (400 60-foot railcars). Together, they can store 877 89-foot railcars (1,262 60-foot railcars). Also, the UP railyard, about 12 miles from the port, has a capacity of 208 89-foot railcars (300 60-foot railcars). Only one of the four rail lines coming into the port has restrictions. The ATSF rail line has 17-foot 3.5-inch and 16-foot 8.5-inch clearance restrictions in the horizontal and vertical directions, respectively. The Port of Beaumont provides the rail switching service between the commercial railyards and the port.

AIR

The nearest commercial airport is Jefferson County Airport. It is about 10 miles southeast of the Port of Beaumont and has two commercial runways. The longest runway is 6,750 feet long and 150 feet wide.

Houston Intercontinental Airport is about 80 miles west of the Port of Beaumont. It has four runways. The longest runway is 12,000 feet long and 150 feet wide.



Rail and Airport Access

The nearest military airfield, at Ellington Air Force Base, is about 80 miles southwest of the port. It has three runways. The longest runway is 9,000 feet long and 150 feet wide.

PORT FACILITIES

BERTHING

The Port of Beaumont is a multicargo terminal consisting of 11 wharves (fig 1). Individual wharves range from 168 to 1,200 feet long. Apron widths vary from 16 feet to open. Except for the RORO dock, the apron heights are all about 16 feet above MLW. The RORO dock height ranges from 6 to 7.5 feet. The depths alongside the berths range from 30 to 40 feet, and the deck strengths range from 250 to 1,200 pounds per square foot. Berths 2-4, 5-7, Harbor Island, and Carroll Street have transit sheds. Because the grain wharf is not suitable for loading/unloading military cargo, we did not consider it in this study.

Pier construction is generally concrete decking supported by either concrete or timber piles, with a steel sheet bulkhead and solid fill. Timber fendering systems front all berths.

Berths 2-4 (Westward View)

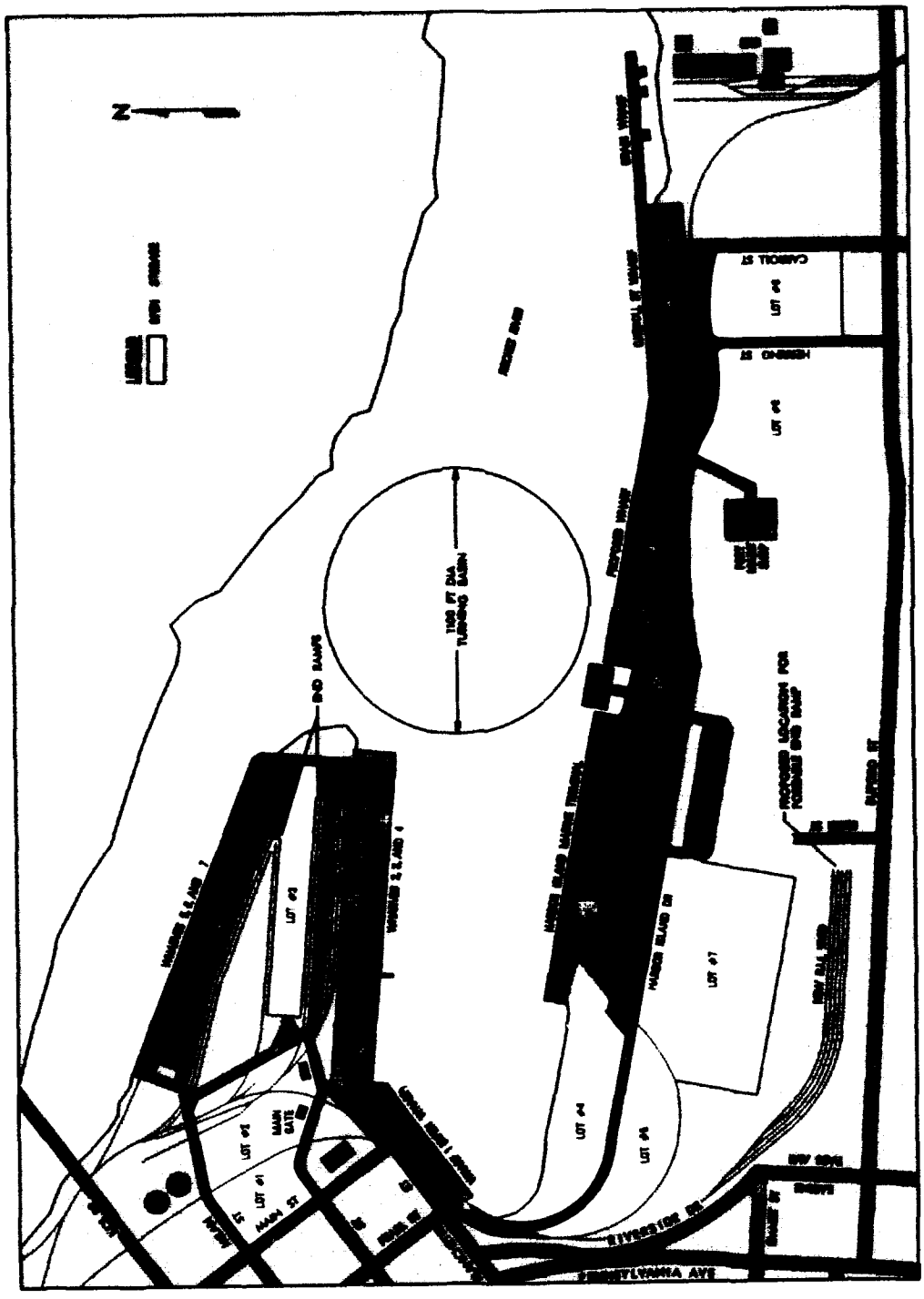
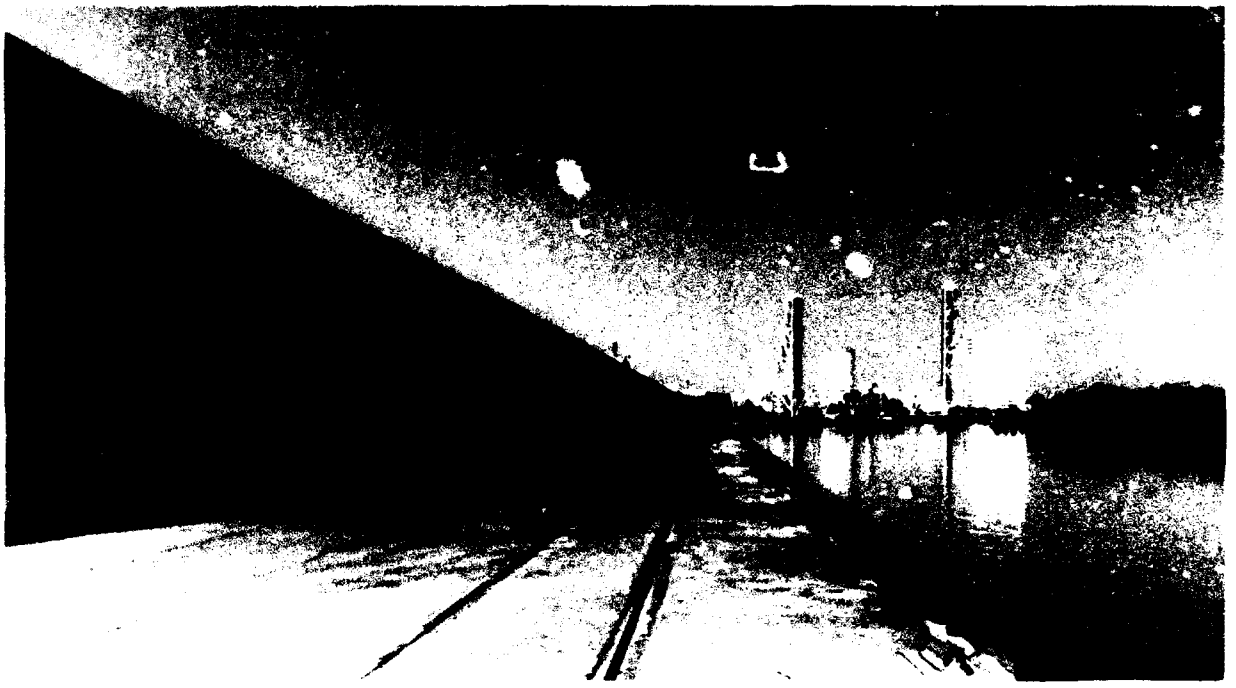


Figure 1. Land-use map.

All berths, except berth 1, are lighted for night operations.

Figure 2 and the accompanying table show the berthing characteristics and capabilities of the Port of Beaumont.



Berth 5-7 (Northwestward View)

Harbor Island Marine Terminal (Westward View)

BERTH CHARACTERISTICS

Length (ft)	765	1,200	580	784	558	1,450
Depth alongside at MLW (ft)	40	40	30	38	38	36
Deck strength (psf)	500	1,200	250	500	500	500
Apron width (ft)	33	97	Open	Open	34	33
Apron height above MLW (ft)	16	16	16	16	16	16
Number of container cranes	0	0	0	0	0	0
Number of wharf cranes	0	0	0	1	0	0
Apron lighting	Yes	Yes	No	Yes	Yes	Yes
Straight-stern RORO facilities	No	Yes	No	Yes	No	No
Apron length served by rail (ft)	0	1,200	0	784	0	1,450

Figure 2. Port facilities and berth characteristics.

STAGING

Open Staging

The Port of Beaumont has 22.5 acres of paved storage, 52.7 acres of limestone/shell storage, and 17.3 acres of grass storage. Of the paved storage, 19.5 acres serves the Harbor Island Marine Terminal (HIMT). Another 3.0 acres of paved storage serves berths 1-4. The limestone/shell storage areas serve berths 1, 2-4, and the Carroll Street wharf.

The open storage is mainly used for containers, vehicles, and general cargo.

Past deployments and exercises have shown Beaumont to be adequate for helicopter operations. The best location to perform helicopter operations is at the 10-acre all-weather open storage area (lot 7) near the HIMT. Lack of lighting restricts usage to daylight operations only.

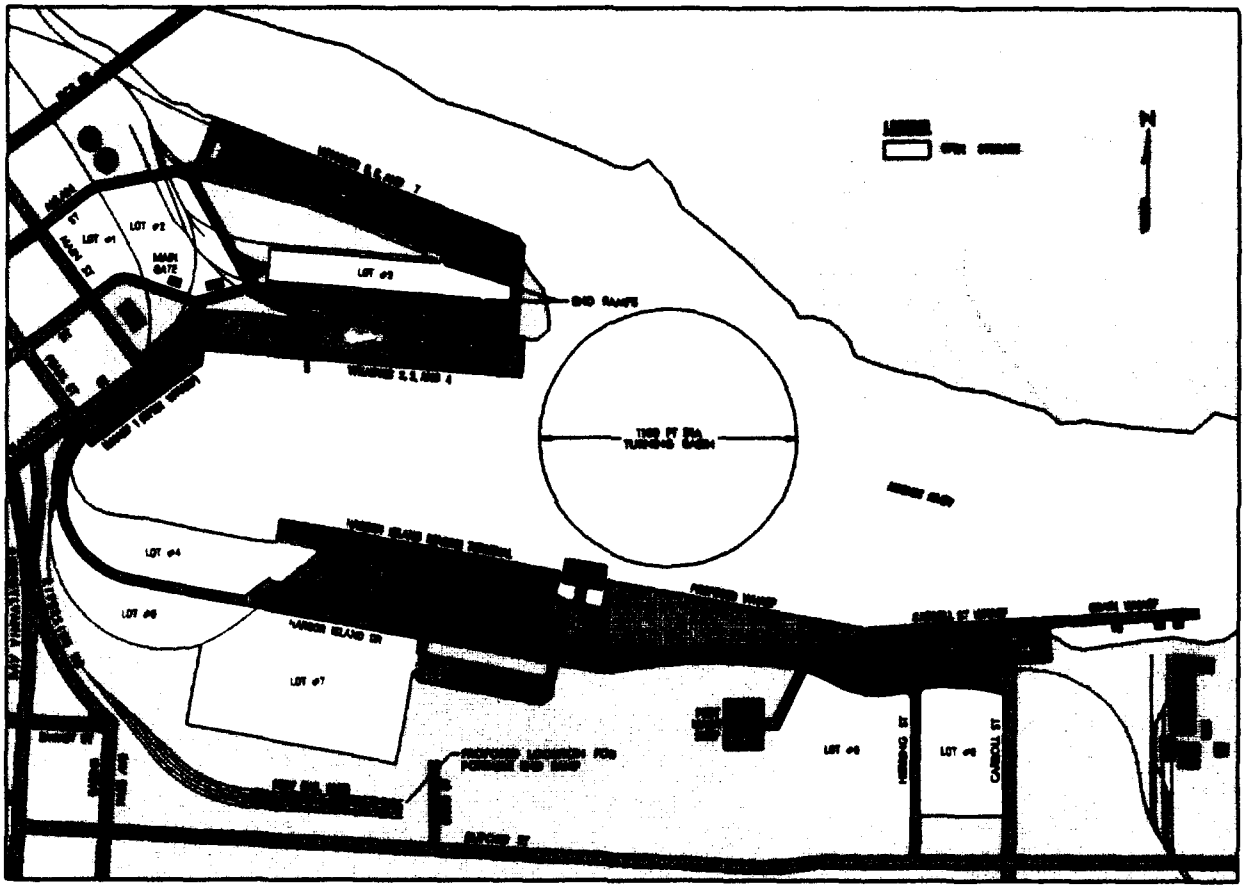
Open Staging Area, Harbor Island

Covered Staging

Five transit sheds provide 487,280 square feet of covered storage for general cargo.

RAIL

The Port of Beaumont maintains its own switching engines. They provide 24-hour rail switching service to the port's apron tracks, transit sheds, and storage tracks. Apron tracks are along piers 2-3, 5-7, and Harbor Island. Also, the five transit sheds have rail access. The Port of Beaumont has the capability to store about 600 railcars in the port area. This number includes the newly constructed rail spurs south of lot 7.



Port Rail and Highway Network

HIGHWAY

Commercial access to the port is by Main, Carroll, Greer, Herring, and Milam Streets. Port security operates Main Street Gate 24 hours a day, while the other gates are opened on an as-required basis. All streets mentioned are two laned and paved.

Truck scales are at the HIMT, behind the transit shed.

Rail Access, Harbor Island Transit Shed

Main Gate Area

UNLOADING/LOADING POSITIONS

Ramps

The port maintains two permanent end ramps inland of the transit sheds for berths 4 and 5.

Also, the port owns two portable end ramps and has several suitable locations for their use. These locations include all berths that have straight tracks along the wharves, except for berth 4 and Carroll Street. Further, all transit sheds are backed by straight tracks. The bulk facilities to the far east and west of the port also have rail spurs suitable for portable end ramps.

The port has the capability to load and unload bilevel and trilevel railcars. A port-owned portable ramp was used with these railcars to unload and load small military vehicles and trailers before and after Desert Storm.

Berths 2, 4, 5, 7, and Harbor Island have fixed truck end ramps.

Rail End Ramp Next to Transit Shed for Berths 5-7

Docks

Three of the 5 transit sheds have truck-level docks that provide a total of 22 truck handling positions. Also, all of the buildings have railcar-level platforms, providing 66 railcar handling positions.

DOCK FACILITIES

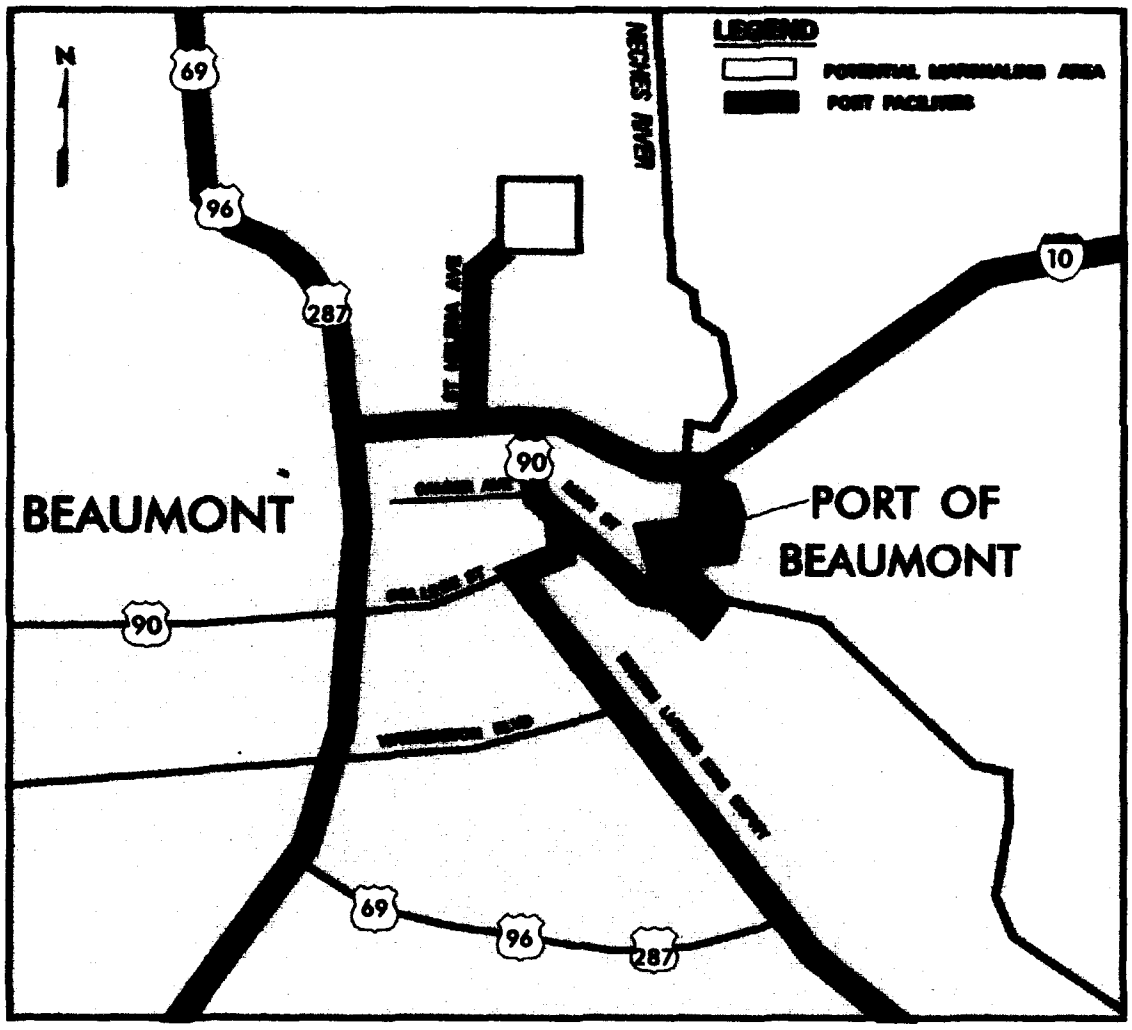
Transit shed 5-6	208,560	5	28	General cargo
Transit shed 4	57,730	12	10	General cargo
Harbor Island shed	112,000	5	16	General cargo
Carroll Street sheds	108,990	0	12	General cargo

Some of the truck and railcar unloading docks also serve as truck or railcar end ramps. This type of facility prevents end ramp and dock unloading operations from happening concurrently.

MARSHALING AREAS

The 10-acre all-weather open storage area (lot 7) near the HIMT may serve as a marshaling area for military equipment. The lot is asphalt paved. This acreage served as a marshaling area in the 1988 REFORGER exercise.

The South Texas State Fairgrounds is a good offsite marshaling area for the port. This area contains 60 acres, including buildings. Most of the open areas are paved parking lots. The fairgrounds are about 3 miles from the port, north of I-10.



No railroad tracks directly access the fairgrounds; however, a small ATSF storage yard, with two permanent end ramps, is about a mile to the west. Helicopter operations may take place at the fairgrounds, if the port is congested. Fort Polk has agreements with the Park and Convention authorities for the use of the fairgrounds.

MATERIALS HANDLING EQUIPMENT (MHE)

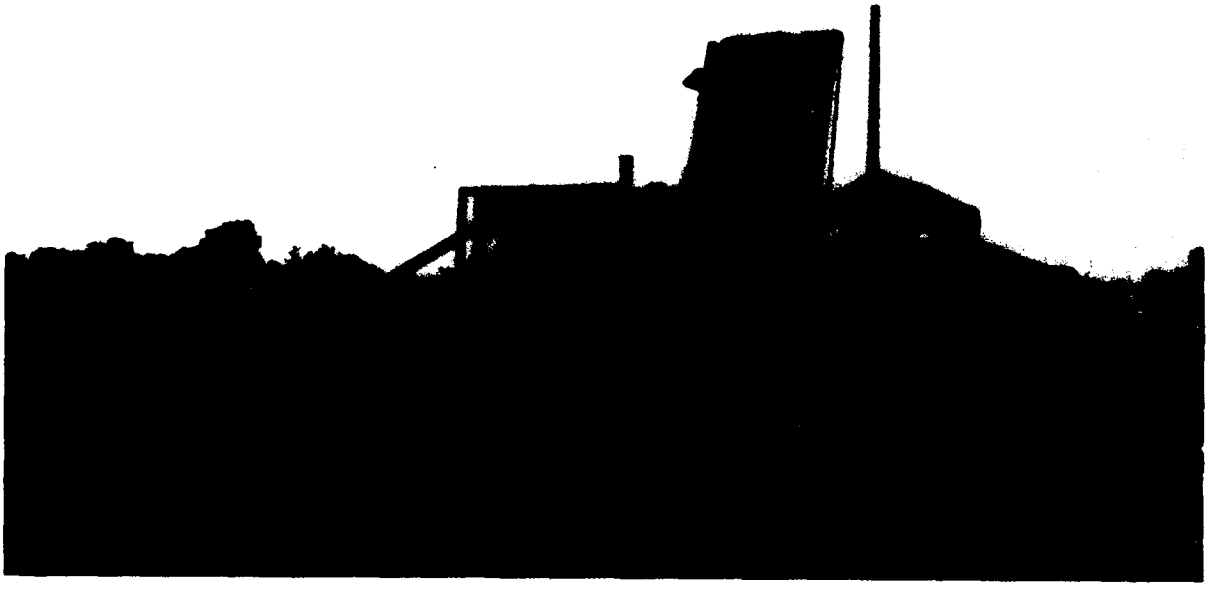
The port has one 220-ton, diesel, mobile crane that serves all berths. This crane supports a 120-foot boom. Also, a traveling, full-portal, gantry crane serves berths 2-3. This crane has a 90-foot radius and capacities of 60 tons at 35 feet and 15 tons at 90 feet.

The stevedoring companies serving the port can provide additional mobile assets, including heavy-lift equipment. Mobile land cranes have lifting capacities up to 220 tons. A 500-ton floating derrick, owned by Trinity Shipbuilding, is also available.

MATERIALS HANDLING EQUIPMENT

Floating crane	500	1
Mobile container crane	220	1
Truck crane	140	4
Truck crane	70	5
Wharf gantry crane	60	1
Lorain mobile crane	50	1
Linkbelt crawler crane	20	1
Container forklift	40	1
Forklift	15	6
Forklift	5-15	30

Gantry Crane, Berth 2-3



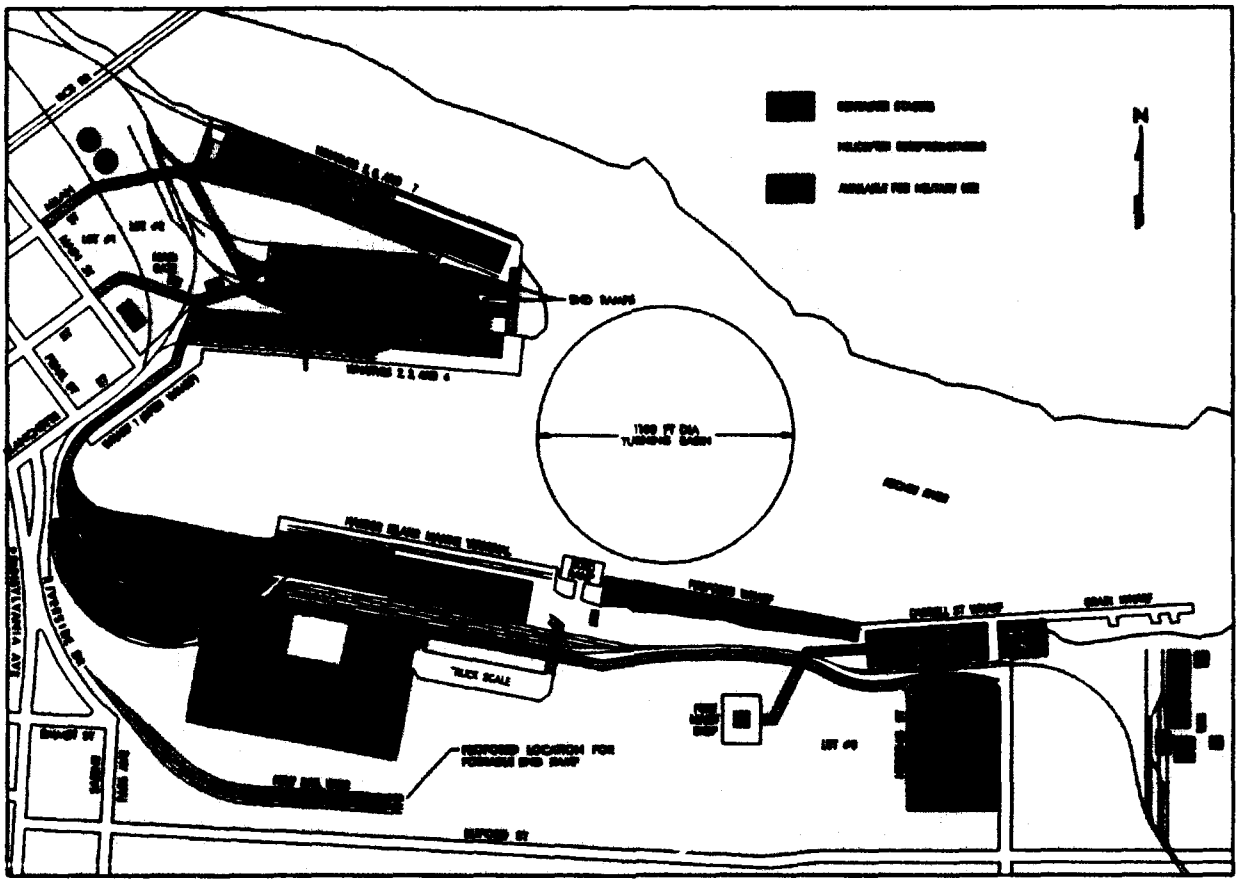
Container Forklift

INTERMODAL FACILITIES

Although the Port of Beaumont has limited container handling capability, it does not have a dedicated intermodal railyard. The nearest intermodal railyards are in Houston (80 miles away). The Ports of National Defense report for the Port of Houston provides information on these facilities.

FUTURE DEVELOPMENT

Plans call for the Port of Beaumont to build a new 1,200-foot berth between Carroll Street and the existing RORO ramp. When this berth is complete, in late 1993, the port will be able to handle three FSS vessels on berth at one time.

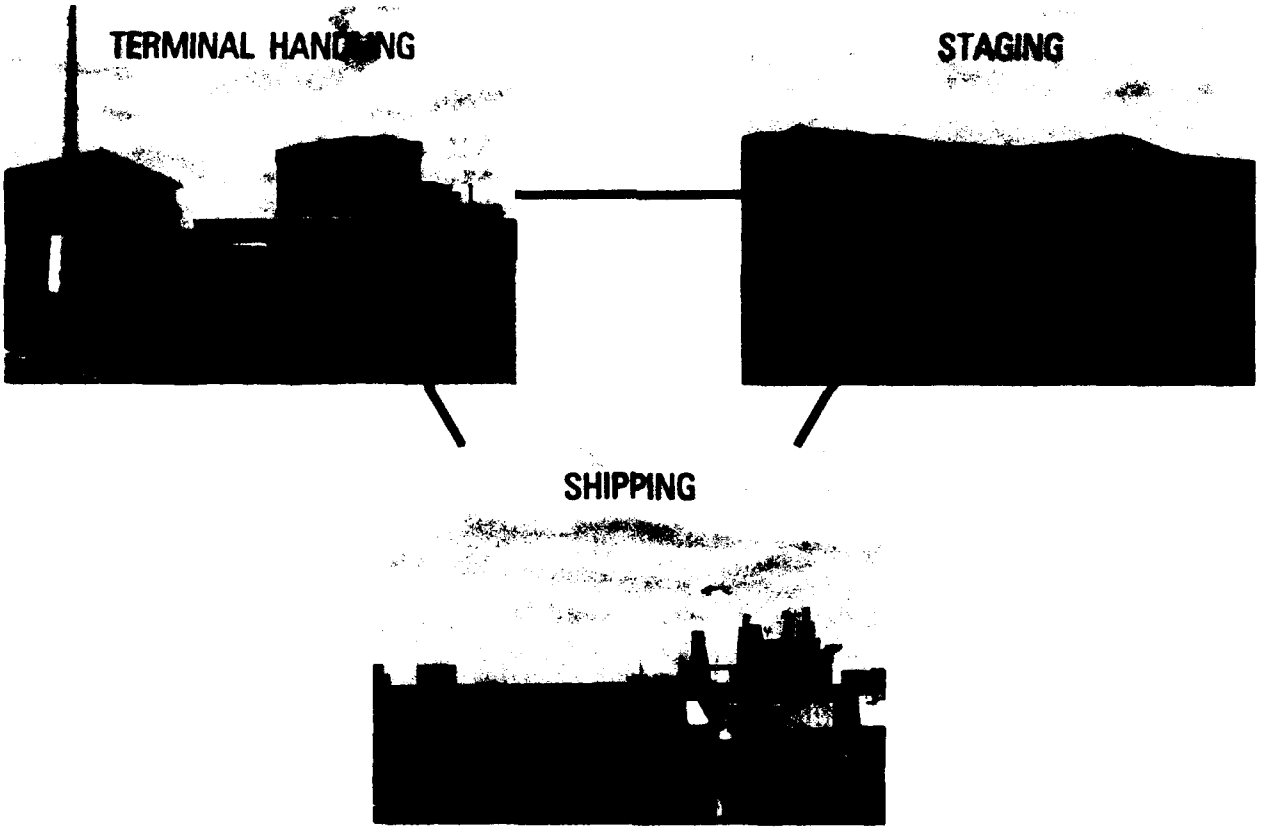


Proposed Wharf Area

II. THROUGHPUT ANALYSIS

GENERAL

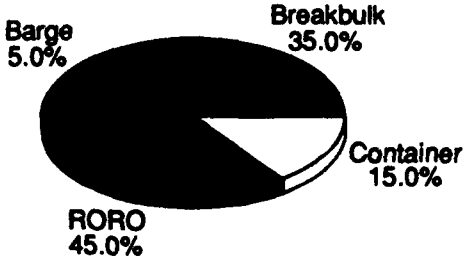
We evaluated the theoretical throughput capability of the Port of Beaumont by using the port operational performance simulator (POPS) computer model. The POPS model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least-capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/handling - in short tons (STON) and measurement tons (MTON) per day.



Terminal Throughput Subsystems

The analysis assumed that 80 percent of the port facilities will support the military deployment. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.

SHIP MIX PERCENTAGES



TERMINAL RECEPTION/ HANDLING

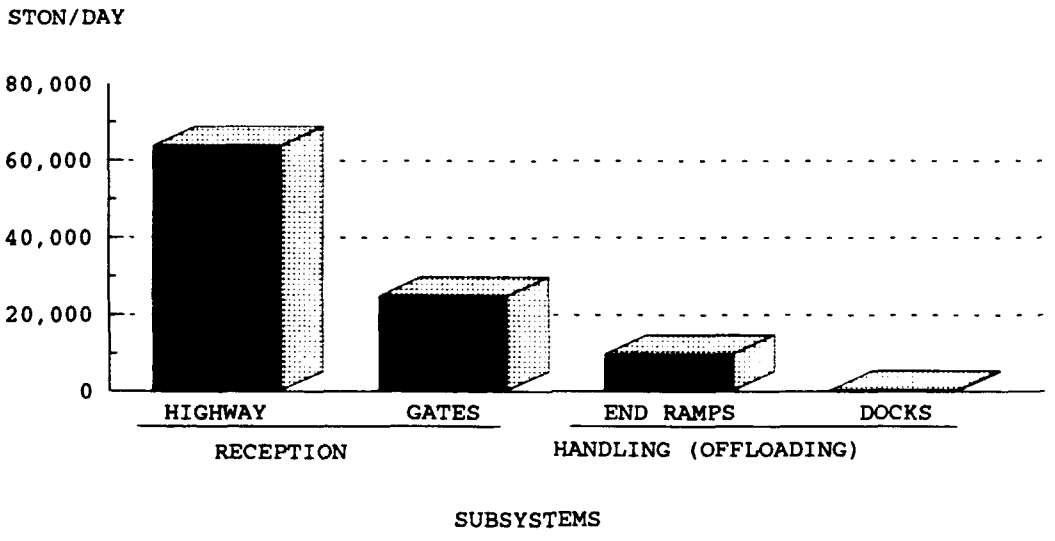
HIGHWAY

I-10 and US 69, 90, 96, and 287 all provide access to the port. Five gates service the port area. Main, Carroll, Greer, Herring, and Milam Streets provide access to these gates and the staging and pier areas of the port. The road network in and out of the port, including the gate processing of vehicles, could handle more than 24,400 STON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to staging areas. Vehicles on commercial or military flatbed trailers, not equipped with a means for unloading vehicles, can offload at various end ramps throughout the port. Based on a scenario of how the port will most likely operate during a deployment, the Army will likely use no more than six truck end ramps (at least one for every wharf) for offloading trailers. This assumption includes using the port's two portable end ramps where the Army needs them. These six ramps could offload about 9,600 STON per day. The port has other fixed end ramps available, if the Army needs to increase the offloading capability.

Supplies in van semitrailers will proceed for offloading to transit shed docks that are not occupied by railcars or used for end ramp operations. The Port of Beaumont has about 22 truck dock handling positions. These facilities could handle about 300 STON of cargo per day. Items capable of direct transfer, such as containers, can proceed either to a staging area for offloading or to the wharf for loading onto the ship. The direct transfer facilities could offload almost 1,380 STON of cargo per day.

HIGHWAY RECEPTION/HANDLING CAPABILITY



RAIL

Rail reception at the port is very good. Four commercial carriers provide access to the port. During Operation Desert Shield, three 60-railcar trains were offloaded per day.

Railyards within the port could store about 600 railcars. Also, commercial railyards within 2 miles of the port could store about 877 additional cars.

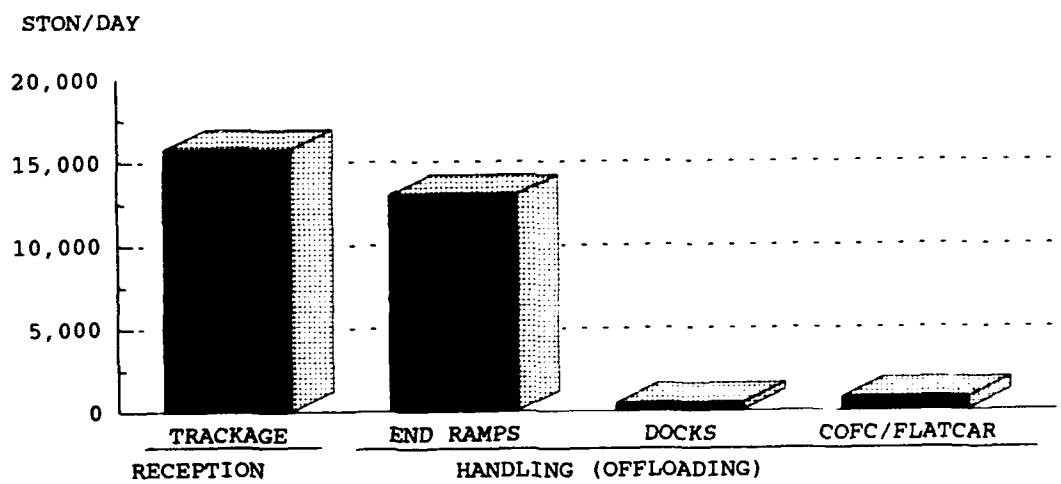
Vehicles on flatcars could be offloaded by using the fixed end ramps at lot 3 (see fig 1) and the portable end ramps at the rail spurs on Harbor Island. Boxcars could be offloaded at the transit sheds, where about 66 rail handling positions are available. Since some of these handling positions are multipurpose (truck dock, rail end ramp, or truck end ramp), availability may be limited during deployment. Although not specifically set up for container-on-flatcar operations, railroad tracks are along the aprons of berths 2, 3, 5, 6, 7, and HIMT, which allow for direct transfer of cargo from wharf to ship.

END RAMP LOCATIONS AND NUMBER OF RAILCARS SERVED

Lot 3, fixed end ramp 1	11
Lot 3, fixed end ramp 2	10
Behind HIMT transit shed*	9
New rail spur near HIMT*	20

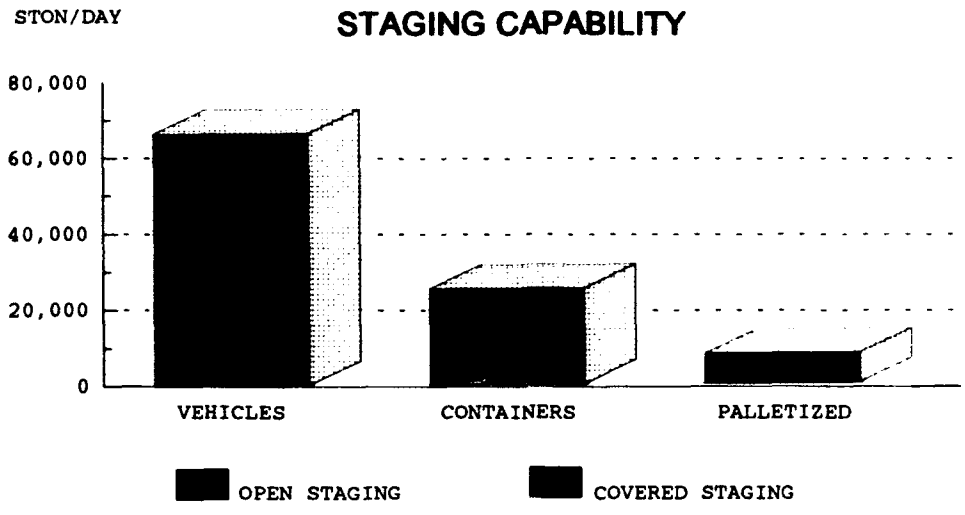
*Portable end ramp.

RAIL RECEPTION/HANDLING CAPABILITY



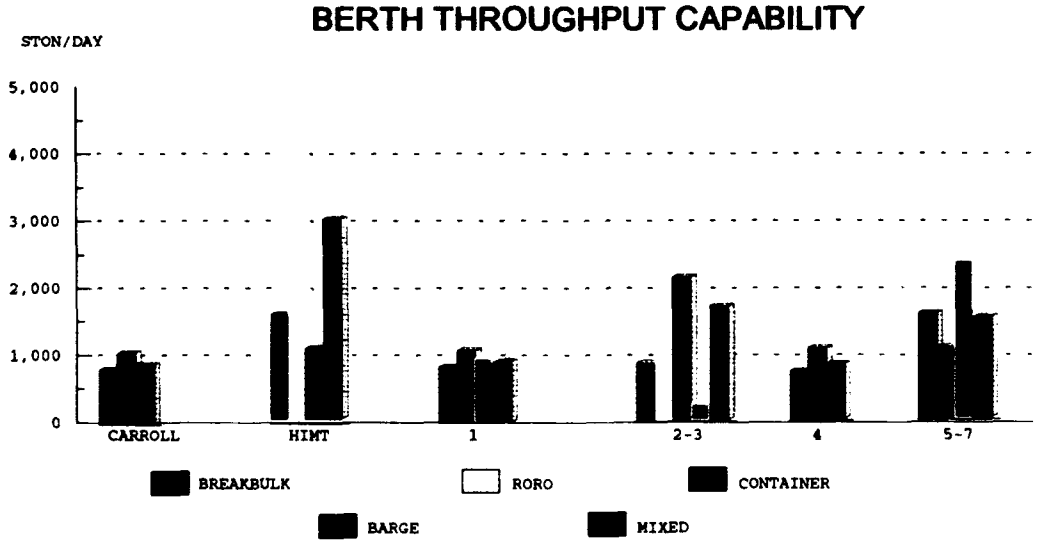
STAGING

The port has about 92.5 acres of open storage for vehicles and/or containers. This staging area has a capability to store about 56,000 STON of breakbulk cargo, 10,100 STON of rolling stock (66,100 STON total), and 25,000 STON of containers. Also, about 487,280 square feet of covered storage provides protection for about 7,800 STON of palletized cargo.



SHIPPING

We identified the throughput capability per berth in STON per day for breakbulk, RORO, container, and mixed vessels. These results were based on various factors, including MHE used, loading, operational, and berth usage rates, as well as berth/ship compatibility.



The berthing capabilities for various vessel types is shown in table 1. The table shows, for each type of ship, the number of vessels that can be accommodated at each berth. The table also provides the limitations that can hinder shipping operations.

The type of ship preferred at each berth is based on methodology that compares the characteristics of the ship berth to a list of ideal factors required to support the different ship mixes. The evaluation takes into consideration the current physical characteristics and MHE available for a berth. This evaluation gives no considerations for enhancements, such as equipment.

The HIMT berth provides the most RORO and mixed throughput capability. Of all the Port of Beaumont berths, it is the most compatible berth for all ship types. Berth 2-3 is also compatible with all ship types.

PREFERENCE BERTH SELECTION

Breakbulk	3	1	6	4	5	2
RORO	-	1	-	2	-	-
Container	4	1	-	3	-	2
Barge	4	1	6	3	5	2
Note: Berths marked with "-" are not recommended for these operations.						

TABLE 1
SUMMARY OF BEAUMONT BERTHING CAPABILITIES

Breakbulk						
C3-S-33a	1	2	a	1	1	2
C3-S-37c	1	2	a	1	1	2
C3-S-37d	1	2	1	1	1	2
C3-S-37a	1	2	1	1	1	2
C4-S-1a	1	2	1	1	c	2
C4-S-1qb and 1u	1	2	a	1	c	2
C4-S-58a	1	2	a	1	c	2
C4-S-65a	1	2	1	1	c	2
C4-S-66a	1	2	a	1	1	2
C4-S-69b	1	1	a	1	c	2
Seatrain						
GA and PR-class	1	2	1	1	c	2
Barge						
LASH C8-S-81b	c	1	a,c,f	c	c	1
LASH C9-S-81d	c	1	a,c	c	c	a
LASH lighter	5	8	4	5	3	10
SEABEE C8-S-82a	c	1	a,c	a,c	a,c	a
SEABEE barge	3	6	2	3	2	7
RORO						
Comet	d,o	i,j	d,i,j	i,j	d,o	d,o
C7-S-95a/Maine-class	b	1,i	a,c	1,i	b,c	b
Ponce-class	b,h	b,h	c,h	h	b,c,h	b,h
Great Land-class	b,c,h	b,h	c,h	c,h	b,c,h	b,h
Cygnus/Pilot-class	b	1,i	c	1,i	b,c	b
Meteor	d,o	i,j	d,i,j	i,j	d,o	d,o
AmEagle/Condor	b	i,j	c	i,j	b,c	b
MV Ambassador	d	2	d	1	d	d
FSS-class	b,c	(1)	a,c	(1)	b,c	b
Cape D-class	b	i,j	a,c	i,j	b,c	b
Cape H-class	b	(1)	a,c	(1)	b,c	b
Container						
C6-S-1w	1,e	1,e	c,e	1,e	c,e	2,e
C7-S-68e	1,e	1,e	a,c,e	1,e	c,e	1,e
C8-S-85c	c,e	1,e	a,c,e	c,e	c,e	1,e
Combination						
C5-S-78a	1,e	1,e	a,c,e	1,e	c,e	2,e
C5-S-37e	1,e	1,e	c,e	1,e	c,e	2,e

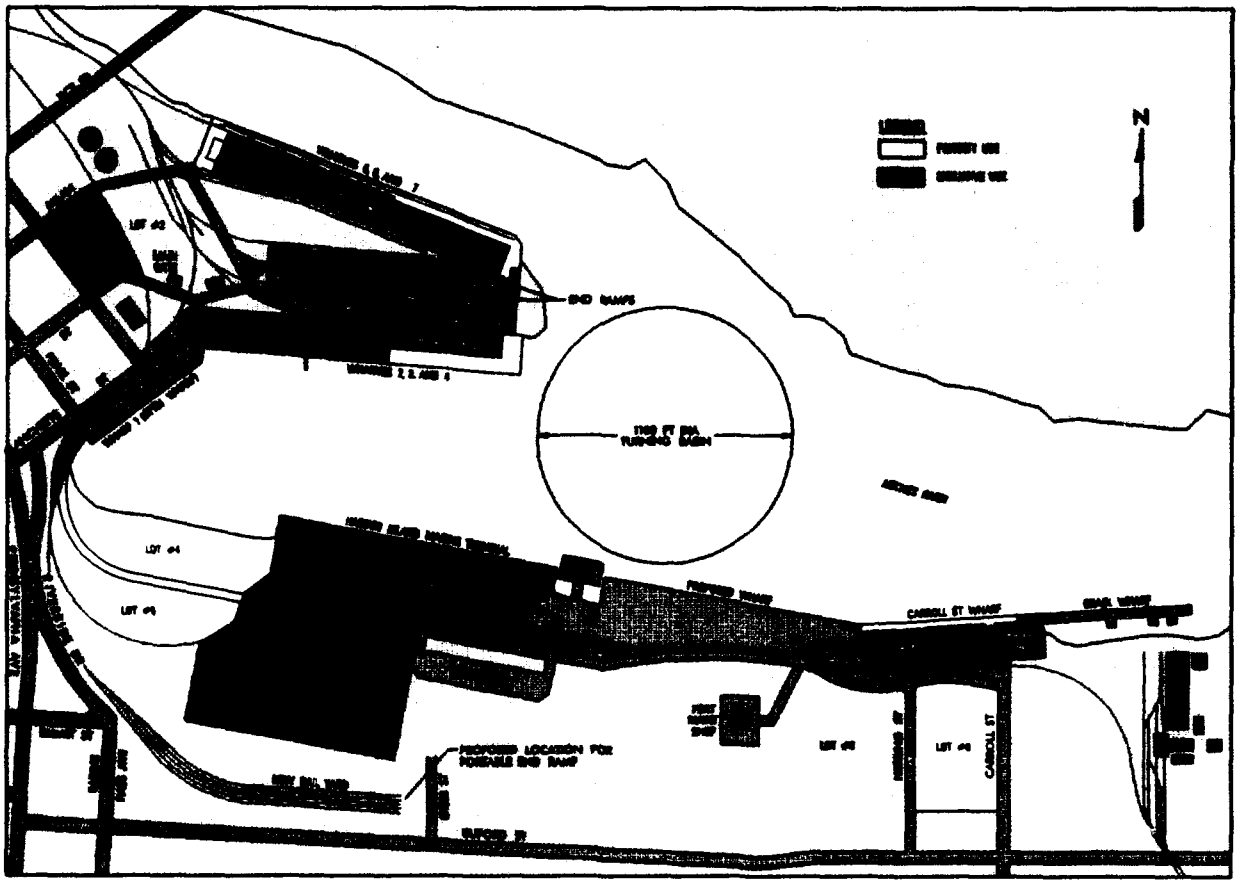
a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

III. APPLICATION

GENERAL

This section of the report will evaluate the throughput capability of the port for deploying a notional unit primarily via FSS vessels. The units evaluated are a mechanized infantry brigade and a mechanized infantry division. The analysis will use only those facilities designated in the *Planning Orders Digest*, issued by MARAD. These orders call for the Port of Beaumont to grant exclusive use and priority of use of certain facilities prior to and during national emergencies. The exclusive use on a continuing basis facilities include HIMT and open wharf; Main Street Facility; wharves 2 and 3 and open wharf; and open storage lots 2, 3, and 7. The priority of use facilities include the Main Street facility; wharves 4, 5, 6, and 7 and transit sheds; Carroll Street wharf; HIMT transit shed; and open lots 4, 5, and 8. The Military Traffic Management Command (MTMC) maintains a detachment at the Port of Beaumont for coordinating military movements.

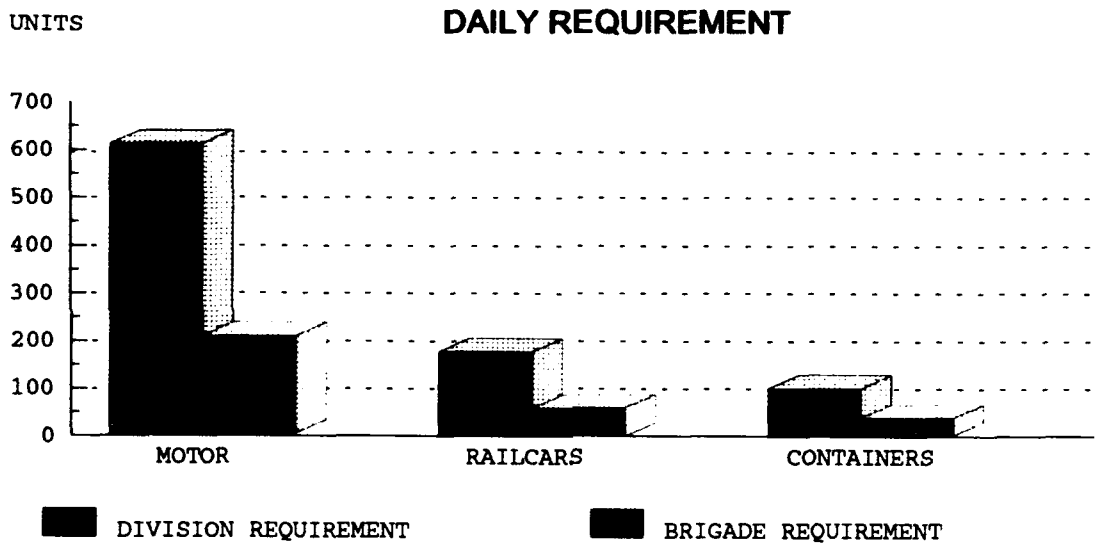


Designated Facilities

REQUIREMENTS

The likely requirement for the Port of Beaumont is to deploy a notional mechanized infantry brigade or division in 6 days. The brigade has to move about 2,600 vehicles and 220 containers. The movement of this brigade to the port will require 360 (60 per day) railcars, using a convoy/rail option. Under this option, about 1,220 (205 per day) roadable vehicles would be driven and about 775 (130 per day) would be towed.

A division has to move about 7,800 vehicles and 660 containers. Using the convoy/rail option, the movement of the division to the port will require about 1,055 railcars (176 per day). For a division, about 3,650 (610 per day) roadable vehicles would be driven and about 2,320 (387 per day) would be towed.



MECHANIZED INFANTRY BRIGADE/DIVISION DEPLOYMENT DATA

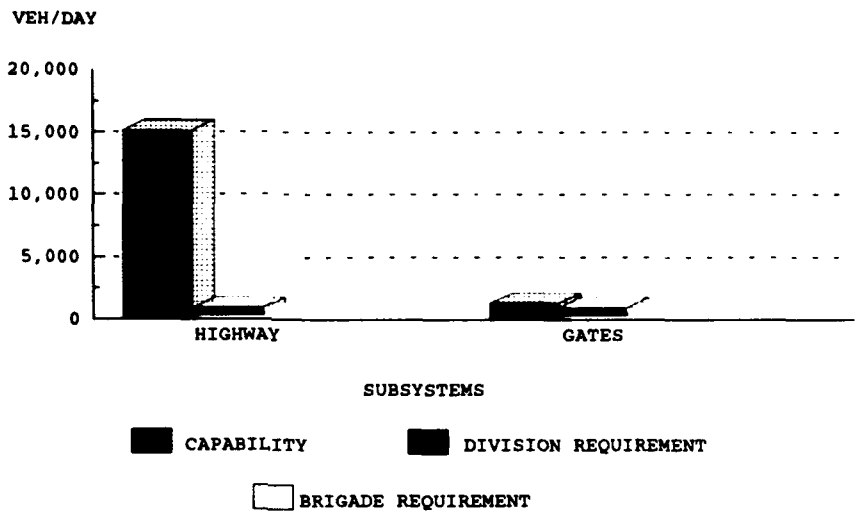
Volume	91,506 MTON	274,518 MTON
Weight	31,670 STON	95,010 STON
Area	474,300 SQ FT	1,422,814 SQ FT
Vehicles	2,600	7,800
Containers	220	660

TERMINAL HANDLING

HIGHWAY

Vehicles could access the port through all five port access gates. Most RORO vehicles could use Main and/or Greer Gates to proceed to the HIMT. Containers on chassis could use Main and/or Milam Gate. If a mechanized infantry division or brigade uses only Main and Carroll Street Gates, the access roads and gates processing subsystems could handle more than 1,200 vehicles per day.

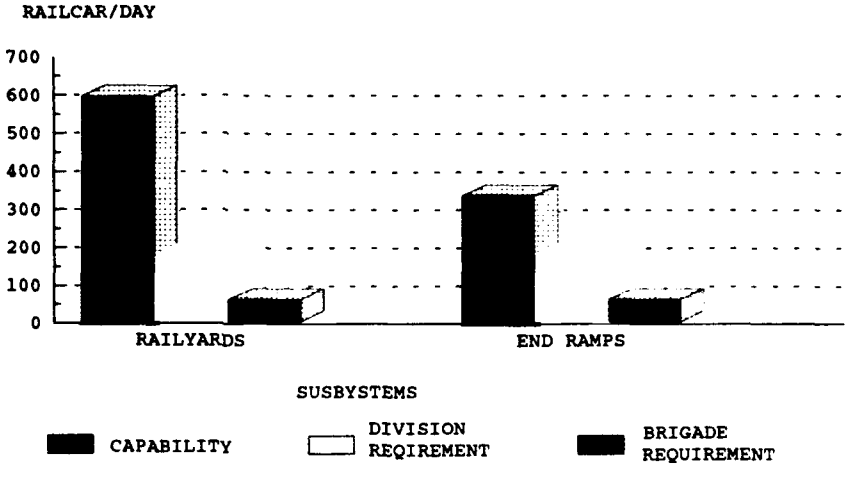
HIGHWAY INPROCESSING CAPABILITY



RAIL

The rail storage yards within the port can store about 600 railcars at one time. During Operation Desert Shield, about 180 railcars were offloaded per day (3 trains of 60 cars each) using the 2 fixed end ramps next to lot 3. This capability could increase by using the two portable end ramps available at the port. Based on the capability rate achieved during Operation Desert Shield plus the potential rate of the 2 portable end ramps (20 railcars each, every 5 hours), the 4 end ramps could offload about 340 railcars per day.

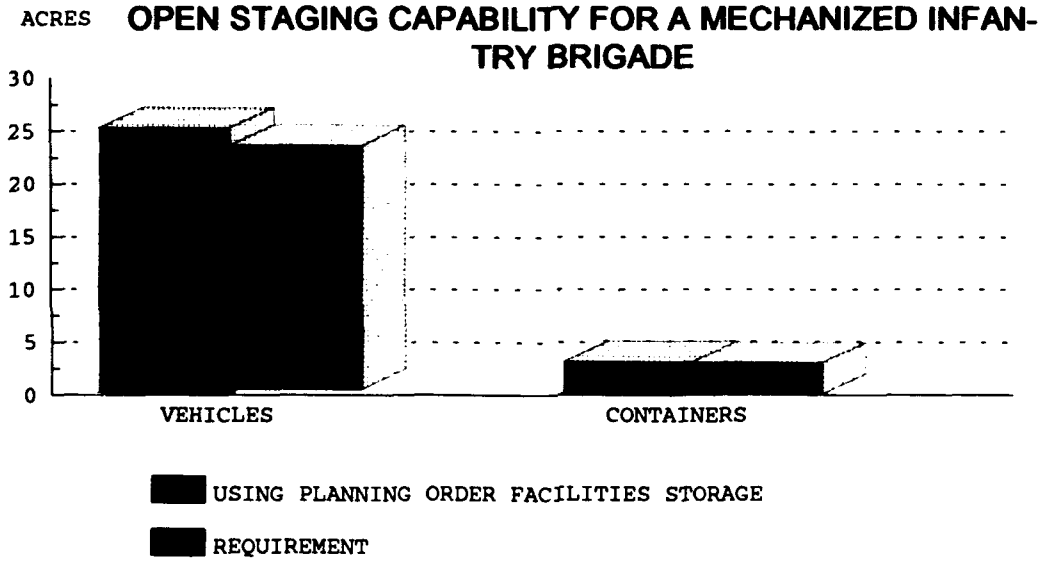
RAIL INPROCESSING/HANDLING CAPABILITY

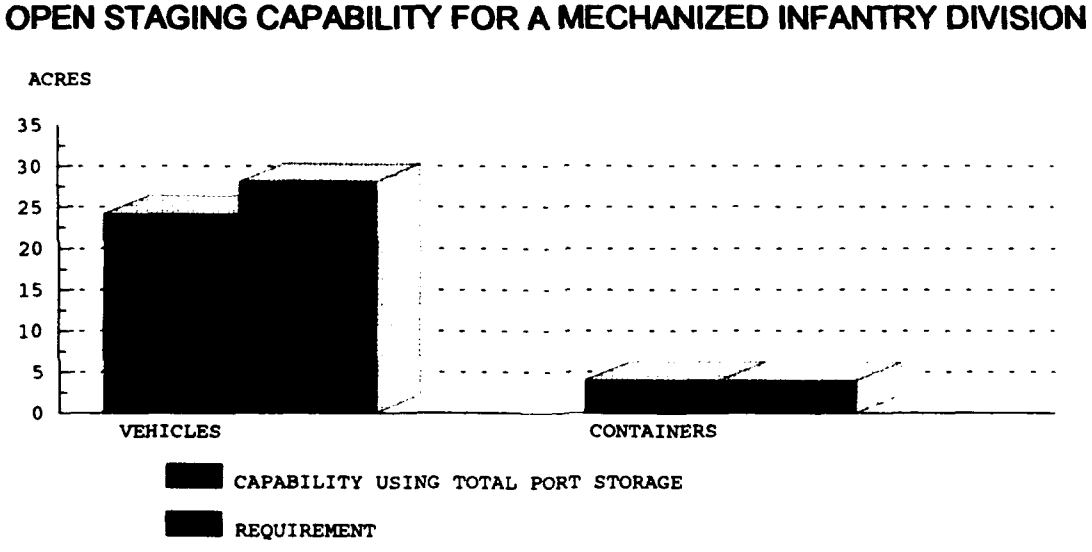


STAGING

Using the *Planning Orders Digest* issued by MARAD, about 28 acres of paved or limestone open storage (17.5 acres exclusive use, 11.5 acres priority of use) are assigned for military operations. We estimate that the Port of Beaumont needs at least 26 acres (23 acres for vehicles and 3 acres for containers) of open staging to support the concurrent loading of two FSS vessels. One berth must have enough open staging to provide sustained loading.

For a mechanized infantry division, the Port of Beaumont needs at least 32 acres (28 acres for vehicles and 4 acres for containers) of open staging to support the concurrent sustained loading of a two-FSS-vessel berth system. The open staging needed for deploying a mechanized infantry division is more than the 28 acres assigned by the MARAD *Planning Orders Digest*. Since the Port of Beaumont has 92.5 acres of available open storage, the Army will require an additional 4 acres to support the outloading of a mechanized infantry division.





SHIPPING

The number of ships needed to load a mechanized infantry brigade depends on the ship mix selected. The best ship mix would require three FSS vessels and one Cape H RORO ship. Based on the assumption 2 days are required to load a ship, a brigade can outload within the 6-day requirement. The Port of Beaumont has two berths compatible with an FSS; therefore, a brigade can outload in about 4 days.

UNIT MOVEMENT REQUIREMENTS
MECHANIZED BRIGADE

Minimum Containerization				
All FSS*	2.67	0.64		
FSS and Cape H	2.22	1.00		
All Breakbulk			12.57	
Maximum Containerization				
FSS and Container	2.64			0.67
FSS, Cape H, and Container	1.54	1.00		0.67
Breakbulk and Container			9.86	0.67

*Only 8 FSSs are available. Unit shipping requirements exceed the capacity of these 8 vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

Legend:

RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, 91.

For a mechanized infantry division, the best ship mix would require all eight FSS's and two Cape H RORO ships. Based on the assumption 2 days are required to load a ship, a division cannot outload within the 6-day requirement. Because the two Cape H RORO ships must also berth at the two FSS berths, a division can outload from the Port of Beaumont in about 10 days.

UNIT MOVEMENT REQUIREMENTS
MECHANIZED DIVISION

Minimum Containerization				
All FSS*	8.00	1.90		
FSS and Cape H	6.64	3.00		
All Breakbulk			37.70	
Maximum Containerization				
FSS and Container	7.90			2.00
FSS, Cape H, and Container	4.62	3.00		2.00
Breakbulk and Container			29.58	2.00

*Only 8 FSSs are available. Unit shipping requirements exceed the capacity of these 8 vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

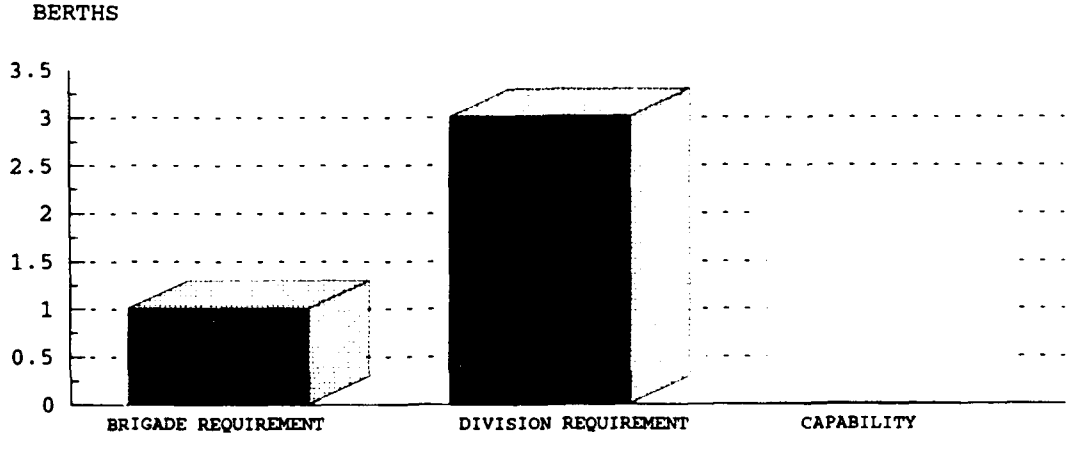
Legend:

RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, 91.

FSS SHIPPING CAPABILITY



SUMMARY

The Port of Beaumont can outload a mechanized infantry brigade within 4 days by using three FSS ships and one Cape H RORO vessel.

The berthing restrictions of the FSS vessels limit the Port of Beaumont to two FSS vessel support systems. Therefore, a mechanized infantry division cannot outload within the 6-day requirement.

The MARAD *Planning Orders Digest* does not assign enough open staging to support the outloading of a mechanized infantry division.

The shipping subsystem is the constraining factor in the throughput capability for the Port of Beaumont.

RECOMMENDATIONS

1. Designate only two brigades of equipment to deploy through the Port of Beaumont, because of berth limitations.

2. The Port of Beaumont should continue to develop the new FSS wharf between HIMT and the Carroll Street wharf. The additional berth would allow a mechanized infantry division to deploy from the Port of Beaumont within 6 days. The third FSS berth can potentially support the deployment of a mechanized infantry division, provided the port can support the staging requirement.

3. Update the MARAD Planning Orders Digest to assign 32 acres of open staging, instead of 28 acres, to support the outloading of a mechanized infantry division.

PORT OF GALVESTON

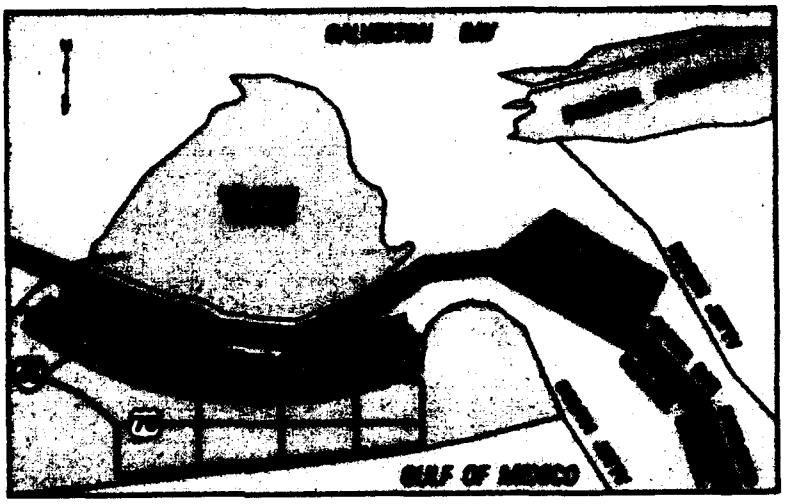
GALVESTON, TEXAS

I. GENERAL DATA

TRANSPORTATION ACCESS

WATER

The Port of Galveston is in southeast Texas, about 50 miles southeast of Houston. It is on the south side of Galveston Channel. This channel separates Galveston Island from Pelican Island and connects Galveston Bay with the Gulf of Mexico.

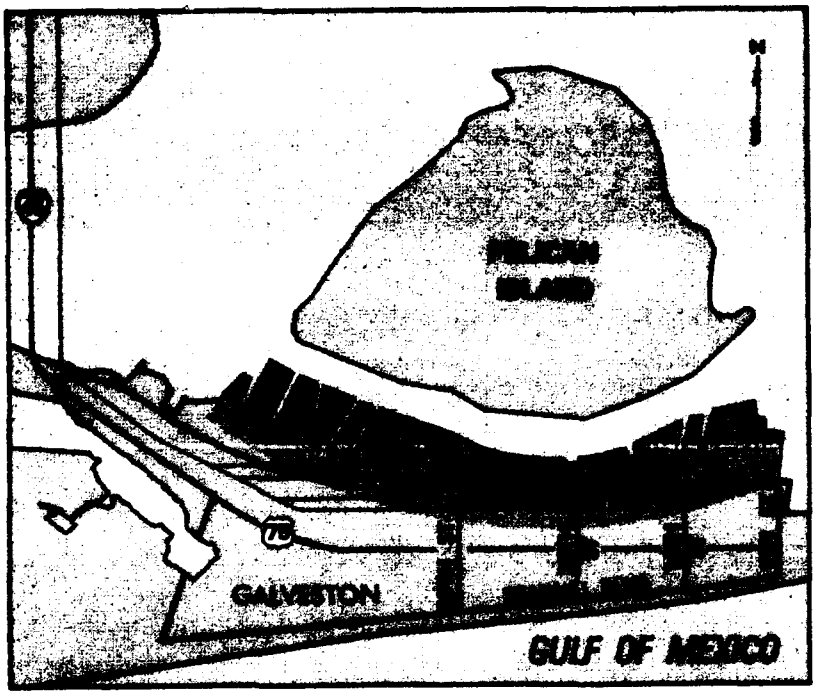


Water Access

Entrance to the port is via four channels. These channels vary from 40 to 42 feet deep and 800 to 1,200 feet wide. No bridges cross the main ship channels between the Gulf of Mexico and the Port of Galveston.

HIGHWAY

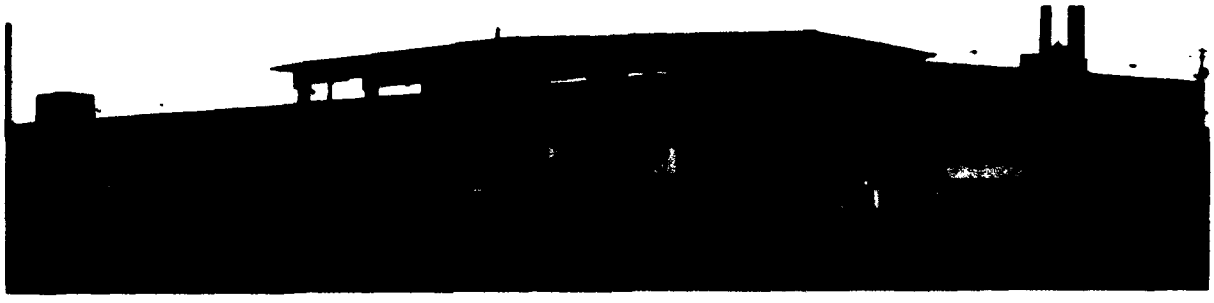
A limited network of highways serve the Port of Galveston. The port has access to Interstate Route 45. From I-45, about 50 miles northwest, are Interstate Route 10 and US Route 59. Commercial access to the port is by Port Industrial Boulevard.



Highway Access

This roadway is 58 feet wide, with four lanes in the port area. Port Industrial Boulevard has heavy traffic congestion during the peak hours. The minimum roadway bridge clearance on Port Industrial Boulevard is 14 feet 7 inches from the port to I-45.

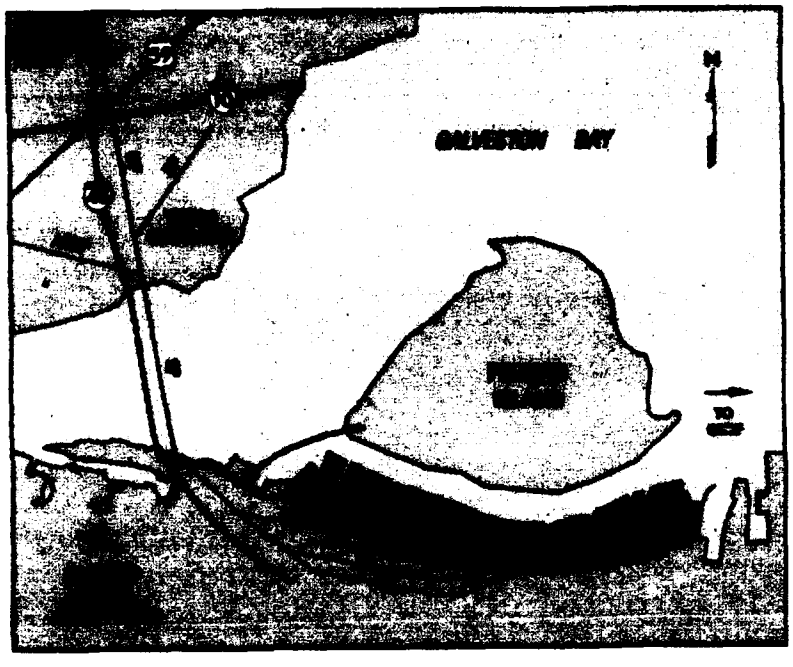
Access to the piers off Port Industrial Boulevard is via 9th, 16th, 37th, and 40th Streets.



Ninth Street Gate

RAIL

Galveston Railway is the commercial carrier serving the port. It performs switching services for Atchison, Topeka, and Santa Fe (ATSF); Burlington Northern(BN); Southern Pacific (SP); and Union Pacific (UP). All these carriers have railyards near the port. Rail clearances are sufficient for bilevel and trilevel railcars to access the port.



Rail and Airport Access

AIRPORTS

Scholes Field is about 5 miles southwest of the Port of Galveston. It has three commercial runways. The longest is about 6,000 feet long and 150 feet wide.

PORT FACILITIES

BERTHING

The Port of Galveston is a multicargo terminal consisting of marginal wharves and finger piers. Wharf construction is generally concrete decking supported by concrete piles and concrete-capped, steel sheet piles. All berths are fronted with timber or rubber fendering systems. Lighting is very good for night operations.

Figure 1 is a land-use map of the Port of Galveston showing the berthing and port facilities. Figures 2 and 3 are aerial views of the port and include tables that identify berth characteristics.

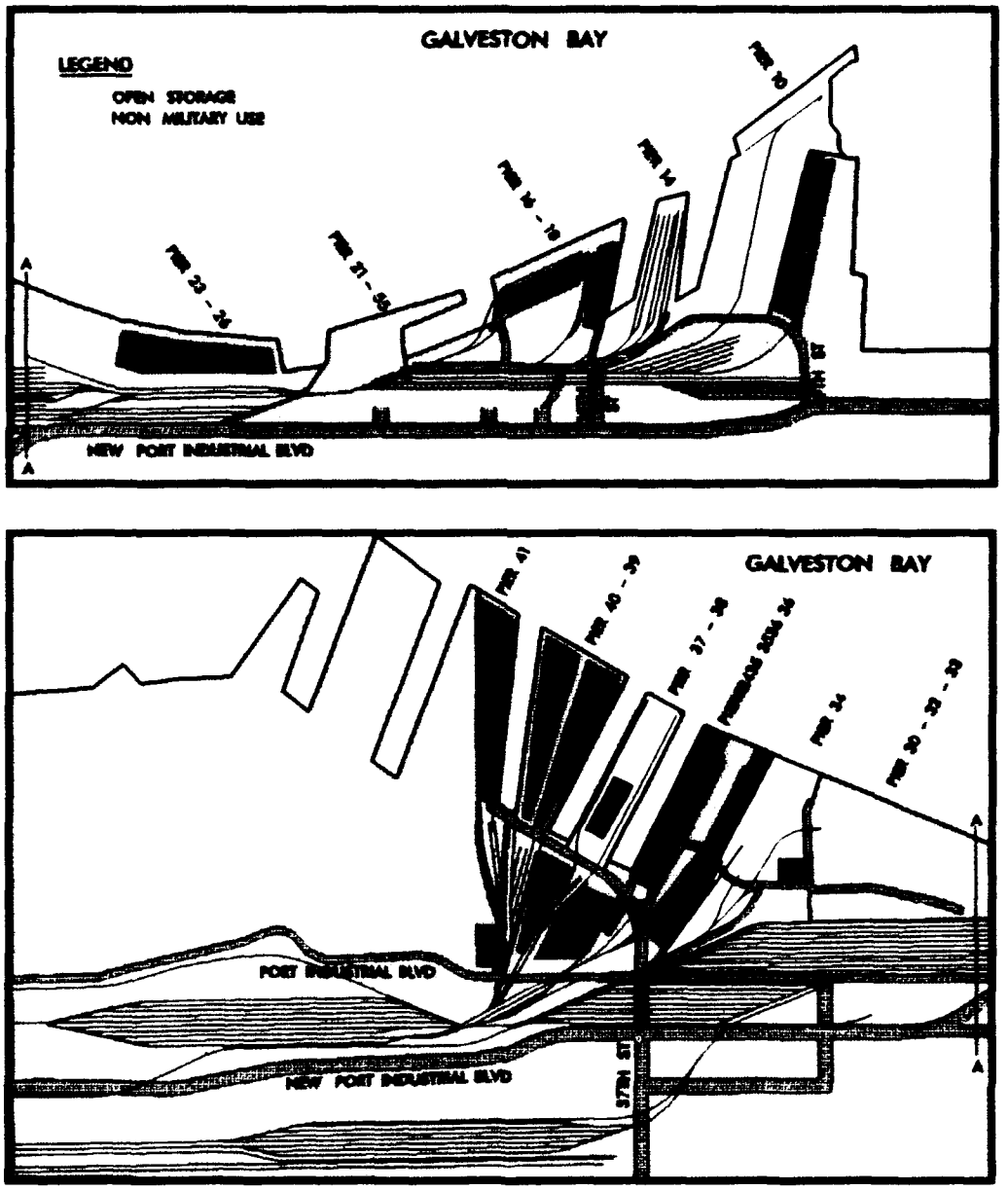


Figure 1. Land-use map.

BERTH CHARACTERISTICS

Length (ft)	1,346	845	663	689	663	1,203
Depth alongside at MLW (ft)	42	34	36	35	35	34
Deck strength (psf)	600	500	500	500	500	500
Apron width (ft)	Open	Open	Open	Open	46	46
Apron height above MLW (ft)	11	11	14	10	12	12
Number of container cranes	4	0	0	0	0	0
Number of wharf cranes	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No	No
Apron length served by rail (ft)	600	0	663	640	600	605

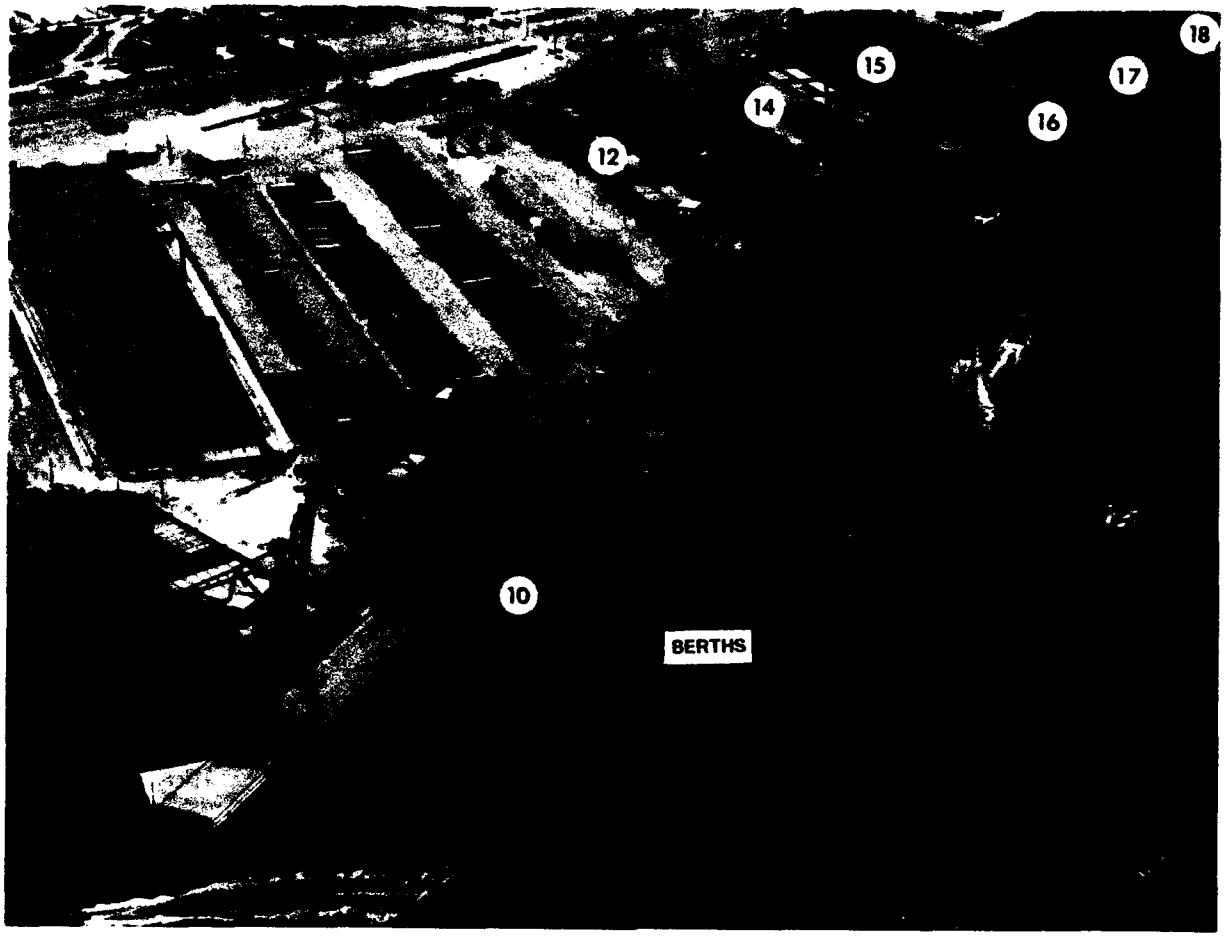


Figure 2. Port facilities (westward view).

BERTH CHARACTERISTICS

Length (ft)	1,415	632	1,206	1,163	1,173	1,164	1,195
Depth alongside at MLW (ft)	32	34	33	34	34	34	34
Deck strength (psf)	500	600	500	500	500	500	500
Apron width (ft)	32	Open	35	Open	38	40	35
Apron height above MLW (ft)	12	9	11	11	11	11	11
Number of container cranes	0	0	0	0	0	0	0
Number of wharf cranes	0	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No	No	No
Apron length served by rail (ft)	0	0	1,160	1,163	0	0	1,195

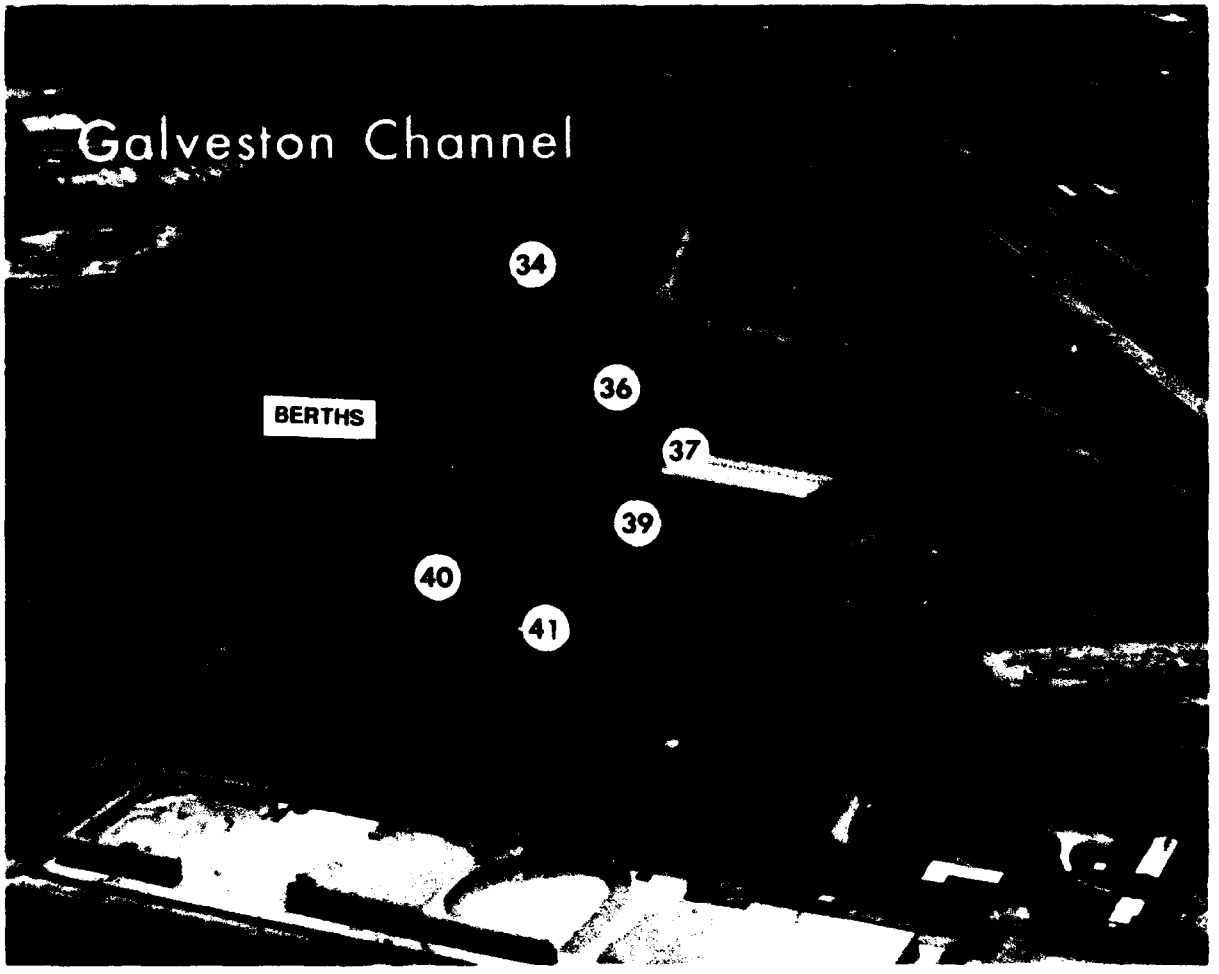


Figure 3. Port facilities (eastward view).

STAGING

Open Staging

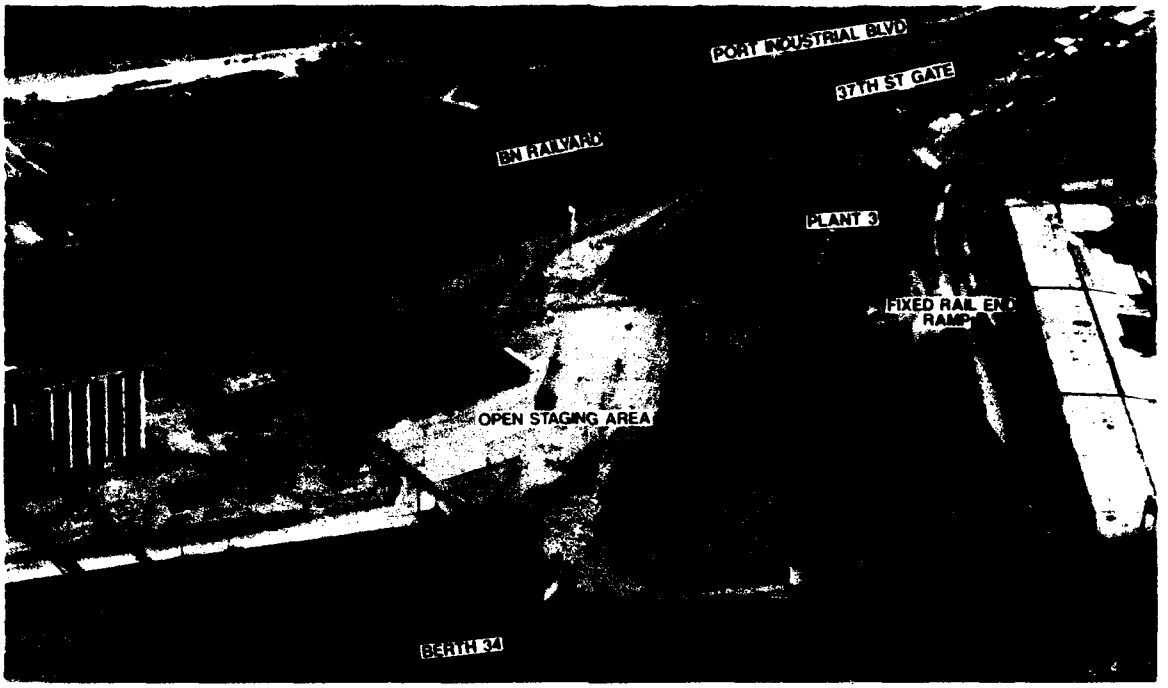
The Port of Galveston has about 70 acres of open staging area (fig 1). Of this, 62 acres are paved and 8 acres are unimproved. Of the paved storage, about 44 acres serve the container terminal and berth 10, 7 acres serve berths 14E and 14W, and 5 acres serve berths 37 and 38. The unimproved storage areas serve berths 34 and 35. The open storage is mainly used for containers and general cargo.

Helicopters can land in the open area of berth 10 and be shrink wrapped in the nearby transit shed. The open area inland of berth 34 is also good for helicopter operations. Lack of lighting restricts the berth 34 area to daylight operations only. Plant 14 or 3 could support shrink wrapping.

Open Staging Areas (Berths 14W, 14E, and 10)

Covered Staging

Sixteen transit sheds and warehouses provide about 2,800,000 square feet of covered storage.



Open Staging Area (Berth 34)

RAIL

Rail trackage links the railyards to the port's apron tracks, transit sheds, and storage tracks. Apron tracks are along piers 10, 14W, 15, 16-18, 36, 37, 38, and 41 (fig 1).

Railyards on the port total about 62,000 feet of track. These railyards have the capacity to handle about 400 railcars. Additional railyards within 2 miles have about 97,000 feet of track.

HIGHWAY

The port has about 10 miles of paved or bricked roadways. All these roads are two-laned and have no clearance restrictions.

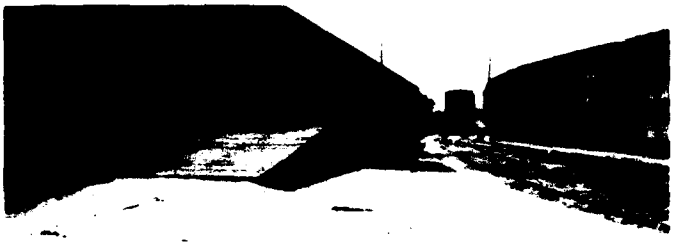
The container terminal operates truck scales at Ninth Street Gate.

Truck Scales at Ninth Street Gate

UNLOADING/LOADING POSITIONS

Ramps

The port maintains one permanent rail end ramp at the north corner of plant 3. Three portable end ramps are also available.



Rail End Ramp

Docks

Eight of the transit sheds have truck-level docks that provide 86 truck handling positions. Most of these buildings have railcar-level platforms. These platforms provide about 165 railcar handling positions.

MARSHALING AREAS

Within Port

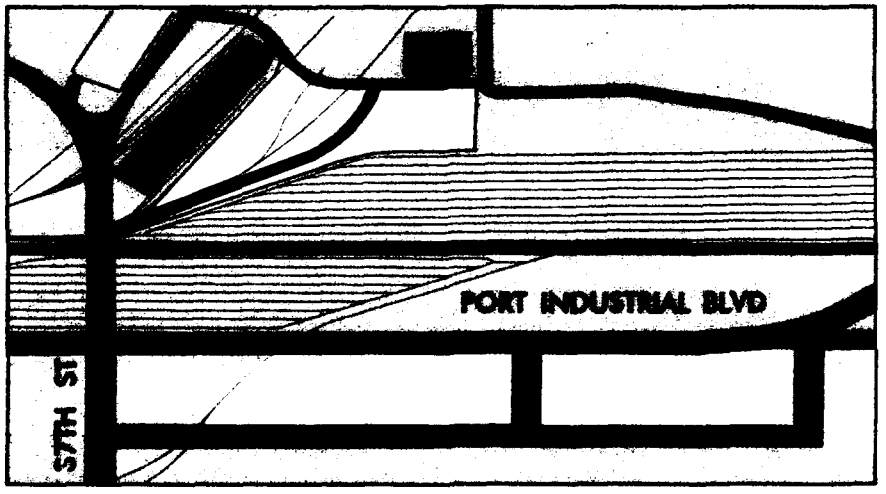
Two potential marshaling areas are near berth 34. The area south of plant 14 is 1.9 acres, and the area next to plant 3 is 2.8 acres.

Santa Fe Fields

Undeveloped tracts of land just south of Port Industrial Boulevard between 30th and 37th Streets provide more than 11 acres. This acreage served as a marshaling area in a 1987 military exercise.

Scholes Airport

Another potential site is the Scholes Airport, about 5 miles from the port. The largest open area consists of about 17 undeveloped acres. Other 3- to 5-acre tracts are also available.



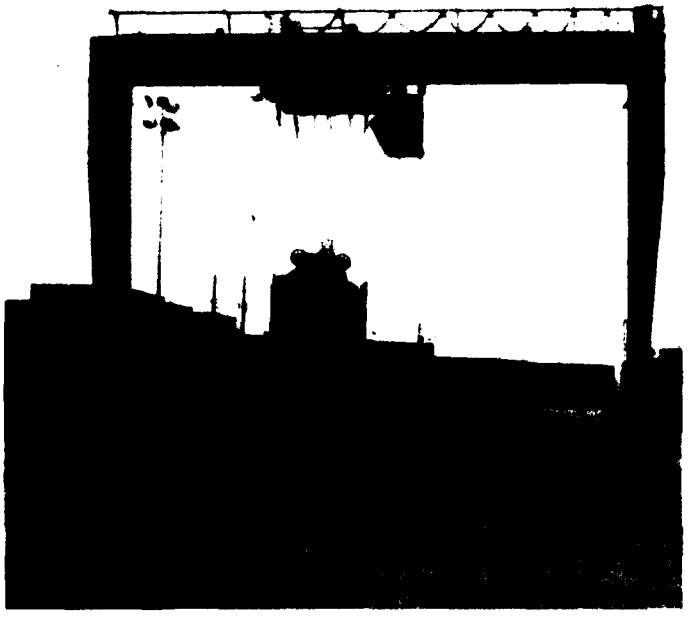
DESIGNATED MARSHALING AREA

Designated Marshaling Area

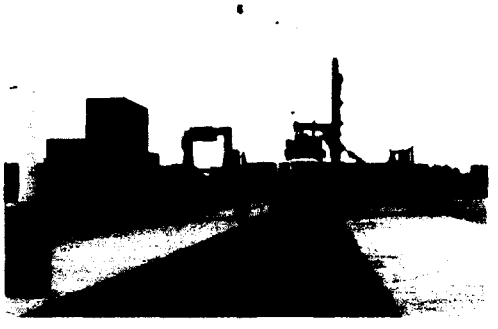
MATERIALS HANDLING EQUIPMENT

One 60-ton, and three 50-ton traveling, container handling cranes serve pier 10. Other materials handling equipment includes container handlers, forklifts, and a transtainer.

Container Cranes



Transtainer



Container Handler

PORT-OWNED MHE

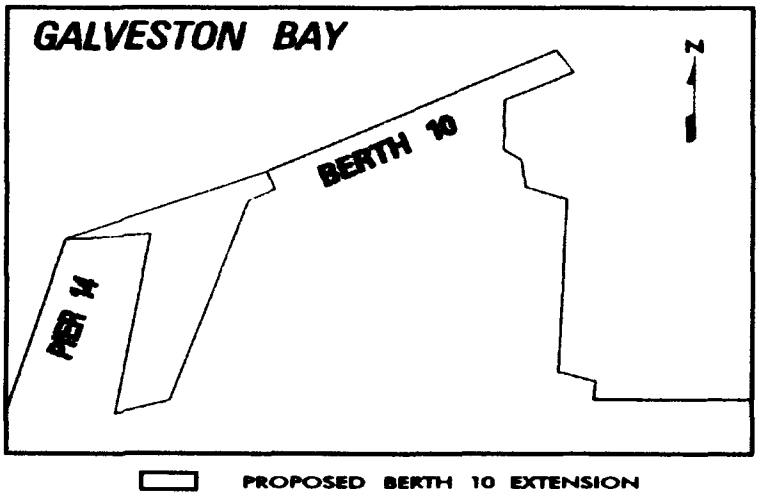
Port packer	36	2
Port packer	42	3
Port packer	42.5	3
Forklift	31	2
Transtainer	40	1

INTERMODAL FACILITIES

The Port of Galveston has intermodal capability. The next nearest intermodal railyards are in Houston. The *Ports of National Defense* report of the Port of Houston provides information on these facilities.

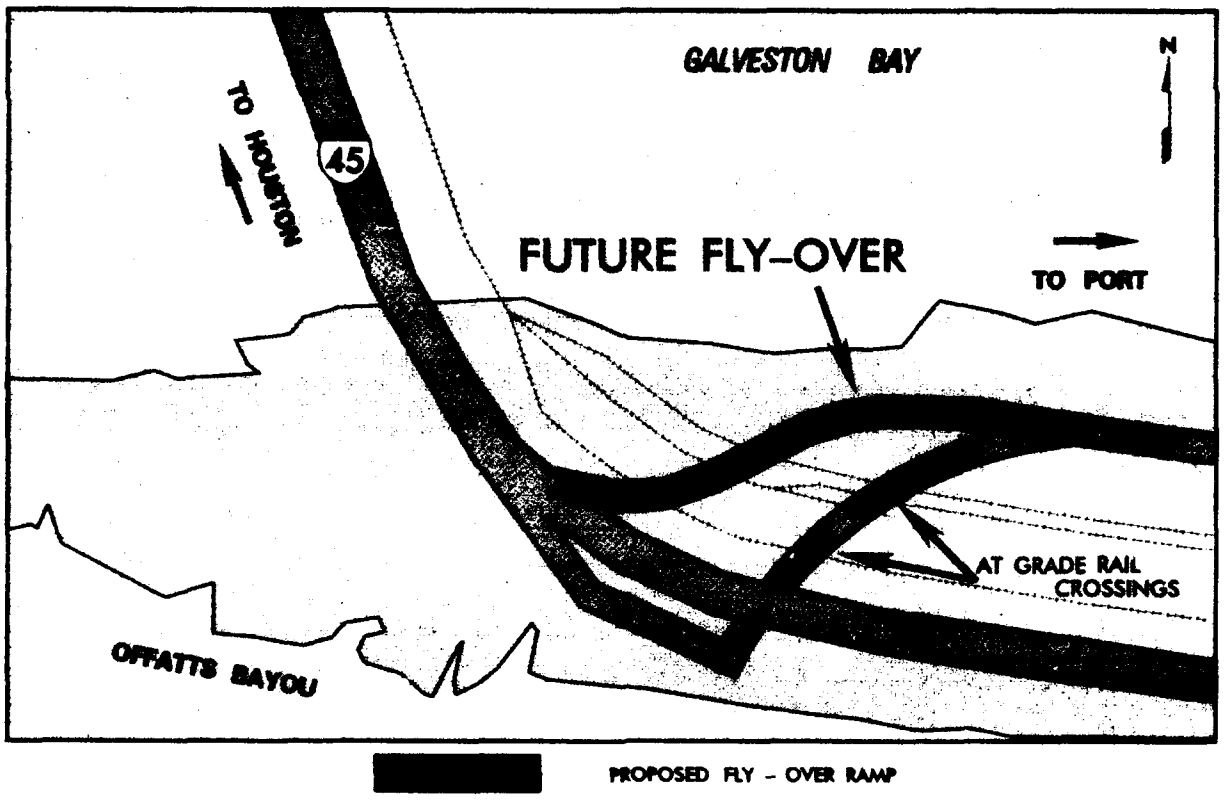
FUTURE DEVELOPMENT

The Port of Galveston plans to extend the container terminal (berth 10) to 2,100 feet. This project will also add 20 more acres to the container storage area and possibly two more container cranes. If funding is approved, the port expects the bulkhead and apron to be operational in early 1995.



Proposed Berthing Extension

Long-term plans exist for improving highway access to the port. A proposal is being studied to develop a flyover ramp to the I-45 causeway. This will eliminate four at-grade rail crossings. Construction is not expected until 2000.

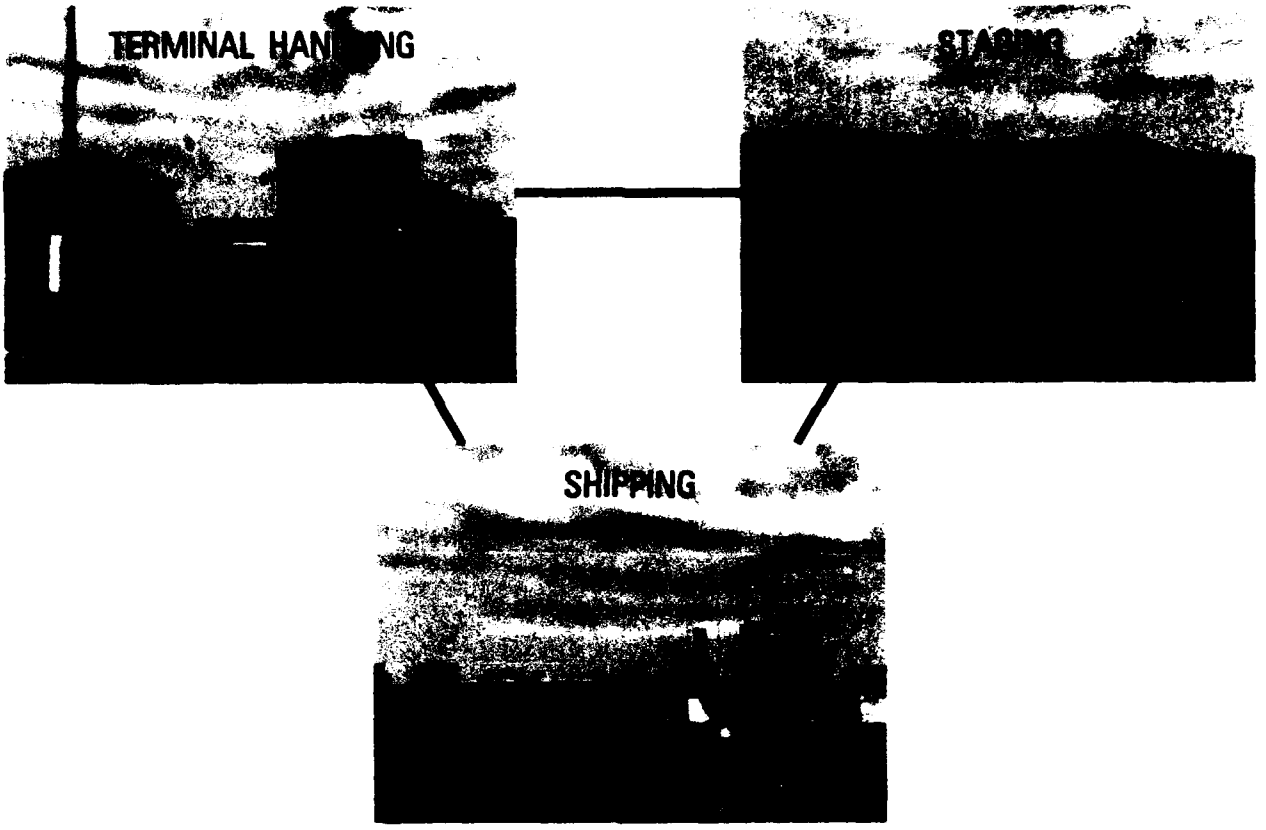


Proposed Fly-Over Ramp

II. THROUGHPUT ANALYSIS

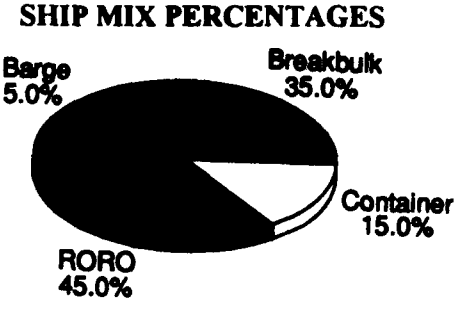
GENERAL

We evaluated the theoretical throughput capability of the Port of Galveston using the port operational performance simulator (POPS) computer model. The model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing - in short tons (STON) and measurement tons (MTON) per day.



Terminal Throughput Subsystems

The analysis assumed that 80 percent of the port facilities will support the military deployment. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.



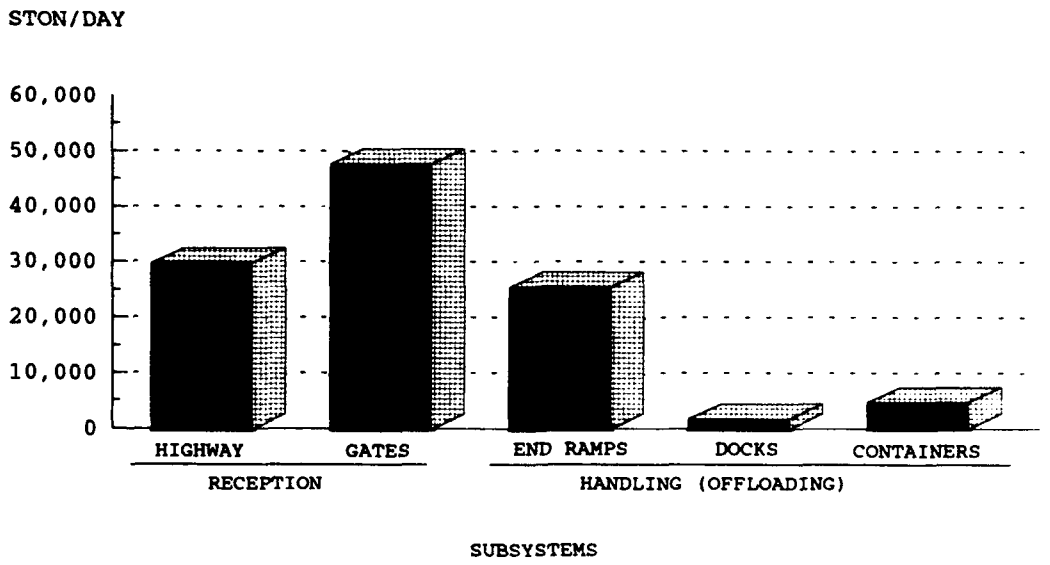
TERMINAL RECEPTION/HANDLING

HIGHWAY

Interstate 45 and Port Industrial Boulevard provide good access to the port. Entrance to the port is provided through four gates off Port Industrial Boulevard, at 9th, 16th, 37th, and 40th Streets. These four port roadways provide access to staging and apron areas. The road network in and out of the port, including the gate processing of vehicles, could handle more than 30,000 STON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to staging areas. Vehicles on commercial or military flatbed trailers will first offload at three portable end-ramp areas. These three ramps could offload more than 25,000 STON of cargo per day. Supplies in van semitrailers will proceed to the transit shed docks for offloading. These facilities provide more than 80 handling positions and could offload about 1,700 STON of cargo per day. Containers on trucks will enter the port through Ninth Street Gate. From there they will move to staging areas for offloading or will go directly to the apron of berth 10. Assuming three container handlers are operating, the port could offload about 4,800 STON of cargo per day.

HIGHWAY RECEPTION/HANDLING CAPABILITY



RAIL

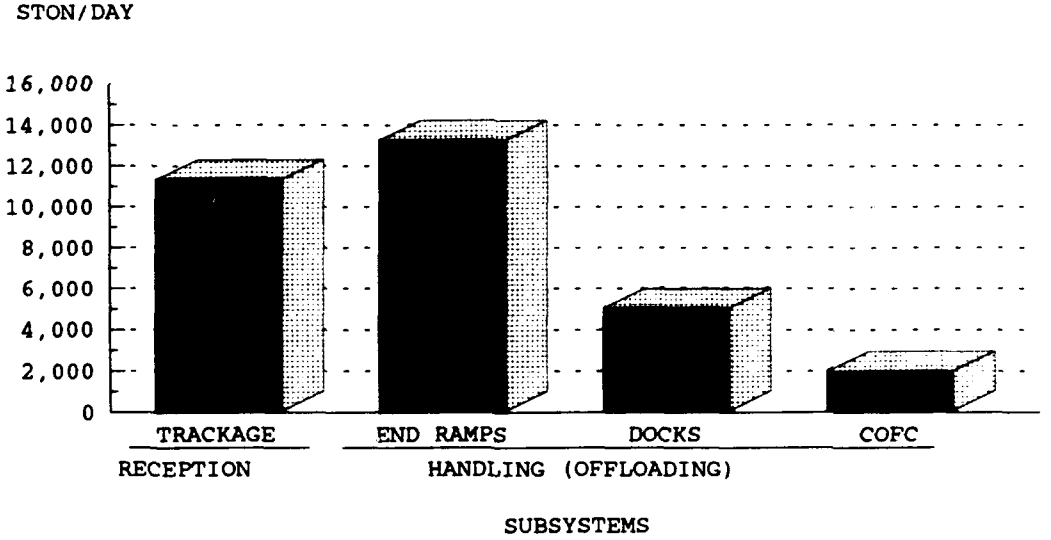
Rail reception at the port is very good. Four commercial carriers providie access to the port. Railyards within the port could store more than 350 railcars. Also, commercial railyards within 2 miles of the port could store more than 500 additional cars. Current rail service to the port is about six 80-car trains per day.

Vehicles on flatcars could be offloaded at four locations within the port by using one permanent and three portable end ramps. Boxcars could be offloaded at the transits sheds, where about 165 rail handling positions are available. Containers would be offloaded at the container handling facility, with three container handlers.

POTENTIAL PORTABLE END RAMP LOCATIONS AND LENGTHS

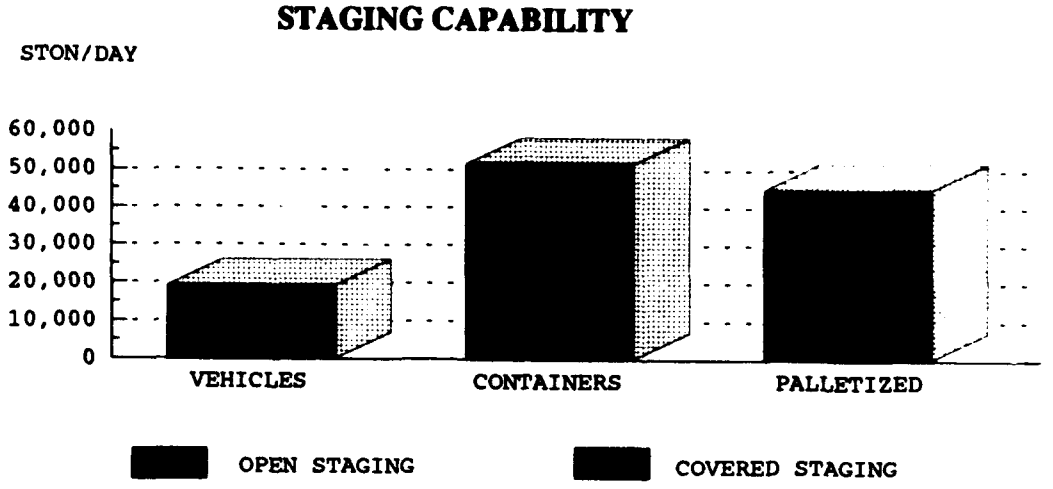
Berth 10 container ramp area (3 ramps total)	11 each
Center of berth 10 open staging	10
West of berth 37 (berth 38 apron)	10

RAIL RECEPTION/HANDLING CAPABILITY



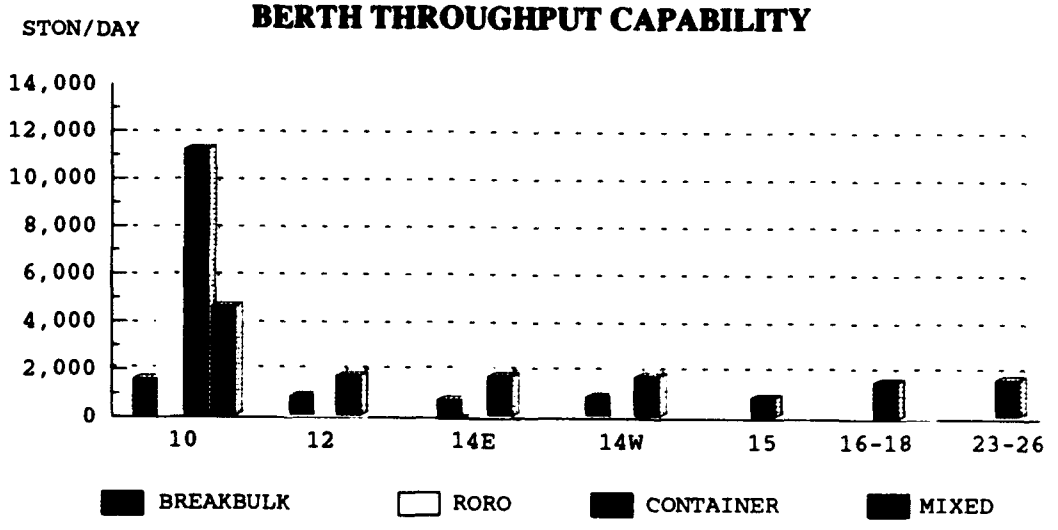
STAGING

The port has about 70 acres of open storage for vehicles and/or containers. It also has about 2,800,000 square feet of covered storage.



SHIPPING

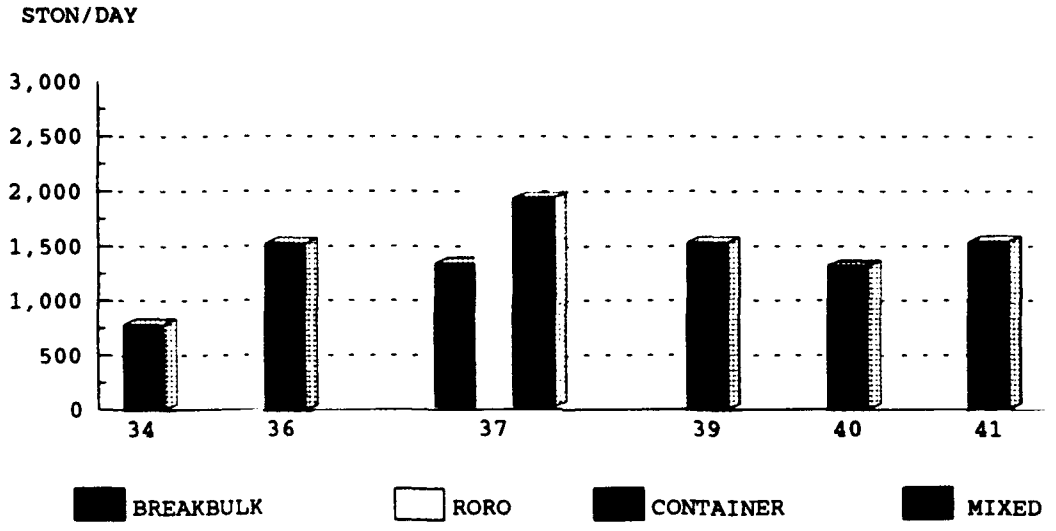
The following chart shows the throughput capability per berth in STON per day for breakbulk, RORO, container, and mixed vessels. These results were based on various factors, including MHE used, loading, operational, and berth usage rates, as well as berth/ship compatibility.



The berthing capabilities for various vessel types are shown in table 1. This table indicates, for each type of ship, the number of vessels that can be accommodated at each berth. The table also provides the limitations that can hinder shipping operations.

The type of ship preferred at each berth is based on a methodology described in the appendix. The evaluation is based on a snapshot view of the current physical characteristics of the berths and the MHE available. The evaluation gives no considerations for enhancements, such as equipment.

BERTH THROUGHPUT CAPABILITY



PREFERENCE BERTH SELECTION

Breakbulk	1	13	11	12	6	2	8	7	4	4	8	8	2
RORO	1	6	4	5	-	-	-	3	-	2	-	-	-
Container	1	-	-	-	-	-	-	-	-	-	-	-	-

Note: Berths marked with "-" are not recommended for these operations.

Berth 10 provides the largest throughput capability for container and RORO vessels. Also, this berth is the most compatible for all ship types.

TABLE 1
SUMMARY OF BERTHING CAPABILITIES OF PORT OF GALVESTON

Breakbulk						
C3-S-33a	2	1	1	1	1	2
C3-S-37c	2	1	1	1	1	2
C3-S-37d	2	1	1	1	1	2
C3-S-38a	2	1	1	1	1	2
C4-S-1a	2	1	1	1	1	2
C4-S-1qb and 1u	2	1	1	1	1	2
C4-S-58a	2	1	1	1	1	2
C4-S-65a	2	1	1	1	1	2
C4-S-66a	2	1	1	1	1	2
C4-S-69b	2	1	1	1	1	1
Seatrain						
GA and PR-class	2	1	1	1	1	2
Barge						
LASH C8-S-81b	1	a,f	c	c	c	a,f
LASH C9-S-81d	1	a,c	a,c	a,c	a,c	a
LASH lighter	9	6	4	4	4	8
SEABEE C8--S-82a	1	a,c	a,c	a,c	a,c	a
SEABEE barge	6	4	3	3	3	6
RORO						
Comet	d,i,j	d,i,j	d,i,j	d,i,j	d,o	d,o
C7-S-95a/Maine-class	1	1	c	c	b,c	b
Ponce-class	h	h	c,h	c,h	b,c,h	b,h
Great Land-class	h	h	c,h	c,h	b,c,h	b,h
Cygnus/Pilot-class	2	1	1	1	b	b
Meteor	d,i,j	d,i,j	d,i,j	d,i,j	d,o	d,o
AmEagle/Condor	i,j	i,j	i,j	i,j	b	b
MV Ambassador	d	d	d	d	d	d
FSS-class	1	c	c	c	b,c	b
Cape D-class	i,j	i,j	c	i,j	b,c	b
Cape H-class	1	a	c	a,c	a,b,c	a,b
Container						
C6-S-1w	1	1,e	1,e	1,e	1,e	1,e
C7-S-68c	1	1,e	c,e	c,e	c,e	1,e
C8-S-85c	1	1,e	c,e	c,e	c,e	1,e
Combination						
C5-S-78a	2	1,e	1,e	1,e	1,e	1,e
C5-S-37c	2	1,e	1,e	1,e	1,e	1,e

a = maximum vessel draft limited to berth depth	h = no shore-based ramps available
b = inadequate apron width	i = insufficient ramp clearance at low tide
c = inadequate berth length	j = insufficient ramp clearance at high tide
d = no straight stern-ramp facilities	k = excessive ramp angle at low tide
e = no container-handling equipment	m = excessive ramp angle at high tide
f = inadequate berth depth, adequate anchorage depth	n = parallel ramp operation only
g = inadequate channel depth	o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

TABLE 1 (Cont)

Breakbulk							
C3-S-33a	2	1	2	2	2	2	2
C3-S-37c	2	1	2	2	2	2	2
C3-S-37d	2	1	2	2	2	2	2
C3-S-38a	2	1	2	2	2	2	2
C4-S-1a	2	1	2	1	1	1	1
C4-S-1qb and 1u	2	1	2	1	1	1	1
C4-S-58a	2	1	2	1	1	1	1
C4-S-65a	2	1	2	1	1	1	1
C4-S-66a	a	1	2	2	2	2	2
C4-S-69b	2	1	1	1	1	1	1
Seatrain							
GA and PR-class	2	1	2	1	2	1	2
Barge							
LASH C8-S-81b	a,f	a,c,f	a,f	a,f	a,f	a,f	a,f
LASH C9-S-81d	a	a,c	a	a	a	a	a
LASH lighter	10	4	8	8	8	8	8
SEABEE C8--S-82a	a	a,c	a	a	a	a	a
SEABEE barge	7	3	6	5	5	5	5
RORO							
Comet	d,o	d,i,j	d,o	d,i,j	d,o	d,o	d,o
C7-S-95a/Maine-class	a,b	c	a,b	1	b	b	b
Ponce-class	b,h	c,h	b,h	h	b,h	b,h	b,h
Great Land-class	b,h	c,h	b,h	h	b,h	b,h	b,h
Cygnus/Pilot-class	b	c	b	1	b	b	b
Meteor	d,o	d,i,j	d,o	d,i,j	d,o	d,o	d,o
AmEagle/Condor	b	c	b	i,j	b	b	b
MV Ambassador	d	d	d	d	d	d	d
FSS-class	a,b	c	a,b	1	b	b	b
Cape D-class	a,b	c	b	i,j	b	b	b
Cape H-class	a,b	a,c	a,b	a	a,b	a,b	a,b
Container							
C6-S-1w	2,e	c,e	1,e	1,e	1,e	1,e	1,e
C7-S-68e	1,e	c,e	1,e	1,e	1,e	1,e	1,e
C8-S-85c	a,e	c,e	1,e	1,e	1,e	1,e	1,e
Combination							
C5-S-78a	a,e	1,e	a,e	1,e	1,e	1,e	1,e
C5-S-37e	2,e	1,e	1,e	1,e	1,e	1,e	1,e

a = maximum vessel draft limited to berth depth	h = no shore-based ramps available
b = inadequate apron width	i = insufficient ramp clearance at low tide
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d = no straight stern-ramp facilities	k = excessive ramp angle at low tide
e = no container-handling equipment	m = excessive ramp angle at high tide
f = inadequate berth depth, adequate anchorage depth	n = parallel ramp operation only
g = inadequate channel depth	o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

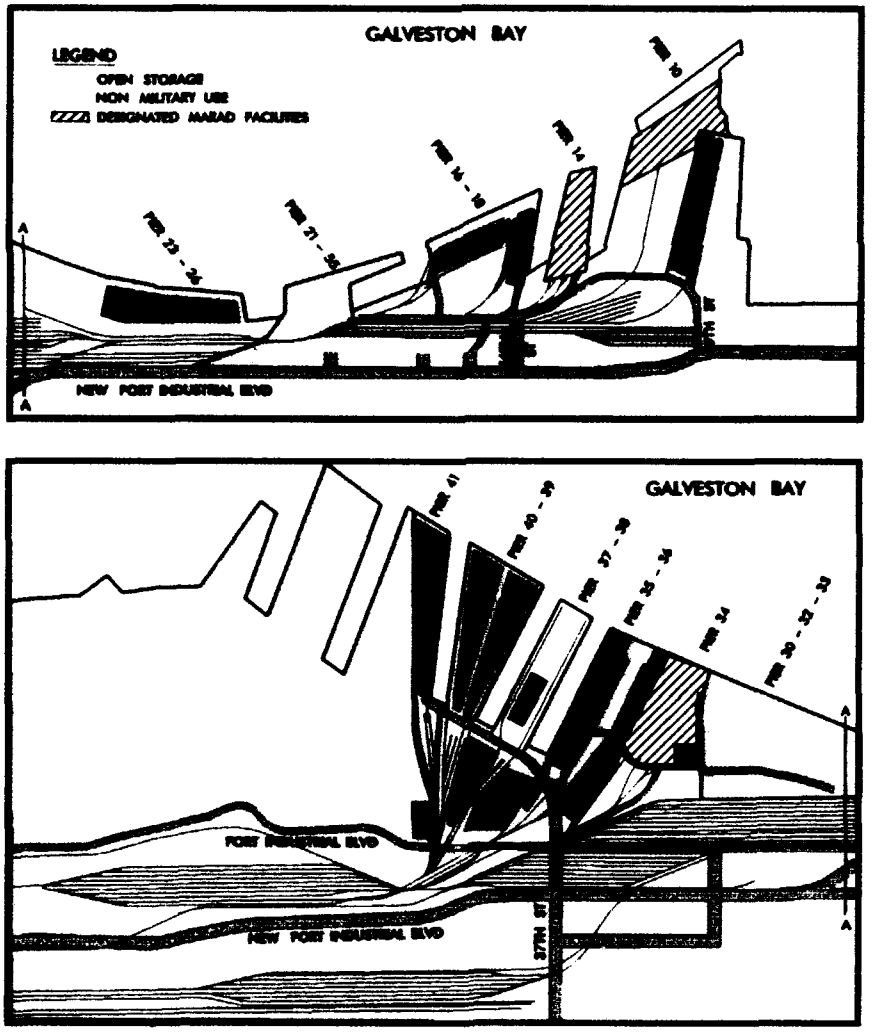
III. APPLICATION

GENERAL

In this section, we will evaluate the port's throughput capability for deploying a notional armored division, using mainly FSS vessels. The analysis will use only those facilities designated in the Planning Orders Digest issued by MARAD. These orders call for the Port of Galveston to grant exclusive use of certain facilities before and during national emergencies. These facilities include berths 10, 14E, 14W, and 34, with associated open staging areas.

PORT OF GALVESTON FACILITIES PLANNED FOR MILITARY USE

10	10.0 open acres and shed
14E	2.5 open acres
14W	2.5 open acres
34	5.0 open acres



Designated MARAD Facilities

REQUIREMENTS

The likely requirement for the Port of Galveston is to deploy a notional armored division in 6 days of ship loading. The division has to move about 7,800 vehicles and 651 containers. This movement requirement to the port will require 1,060 (180 per day) railcars using the convoy/rail option. Under this option, about 3,700 (620 per day) roadable vehicles would be driven, and about 2,300 (380 per day) would be towed.

ARMORED DIVISION DEPLOYMENT DATA

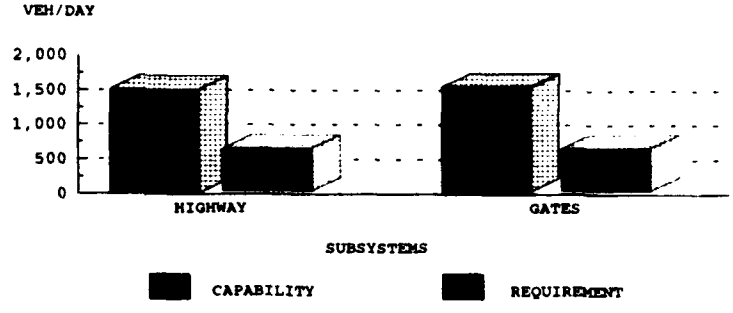
Total Equipment	
Volume	275,000 MTON
Weight	97,000 STON
Area	1,428,000 SQ FT
Vehicles	7,800
Containers	651

TERMINAL HANDLING

HIGHWAY

Vehicles would access the port from Port Industrial Boulevard through 37th Street Gate for deployment from berth 34, 16th Street Gate for berths 14E and 14W, and 9th Street Gate for berth 10. Containers on chassis would arrive through Ninth Street Gate. Both the access roads and gate processing subsystems could handle more than 1,500 vehicles per day.

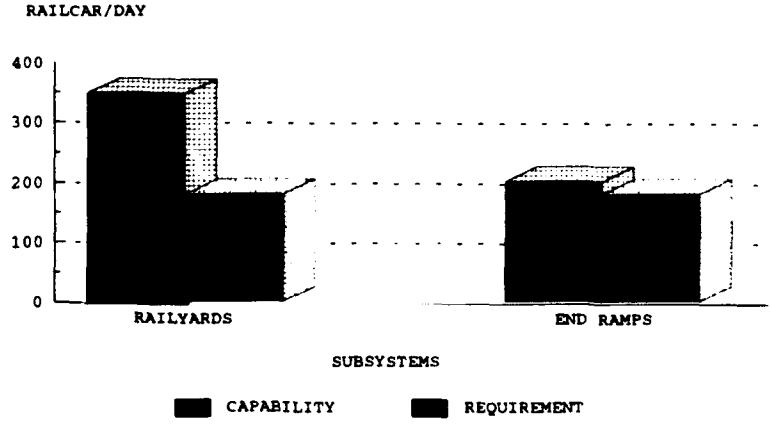
HIGHWAY INPROCESSING CAPABILITY



RAIL

The classification yards within the port could easily handle more than 350 railcars per day. Also, the 4 end-ramp offloading locations could offload about 50 railcars every 5 hours, or more than 200 railcars per day.

RAIL INPROCESSING/HANDLING CAPABILITY

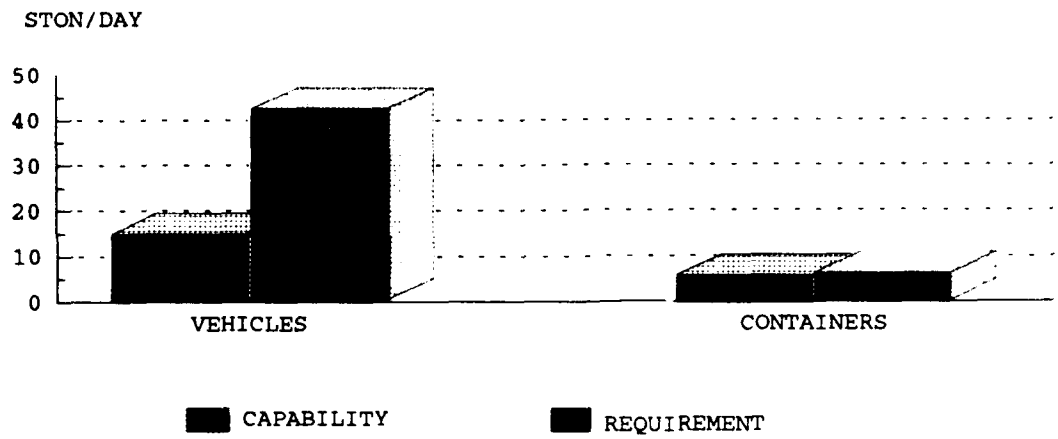


STAGING

This analysis assumes that current downsizing continues, and nine FSS-sized ships will deploy an entire notional armored division. Three ships will depart every 2 days. Because of this, the staging requirement is to support three sustained loading operations. Although an FSS cargo-load can be staged and loaded on 10 acres, 16 acres are required for each sustained loading operation. Of these 16 acres, about 2 acres are required for staging the containers for each FSS. The three simultaneous shiploading operations will require 48 acres of open staging, of which 6 acres are dedicated to staging containers.

The port has only 20 acres of open staging that could support military operations at the Port of Galveston. This staging area is not enough for the three simultaneous FSS loading operations.

OPEN STAGING CAPABILITY



SHIPPING

Although this analysis assumes that only nine FSS-sized ships can deploy the notional armored division, the table below provides ship quantities for the current division size. The number of ships required depends on the shipping mix selected. The best ship mix would consist of all eight FSSs and two Cape H RORO ships.

The only berth at the Port of Galveston that can support FSS operations is berth 10. The capability to berth only one FSS does not meet the requirement.

UNIT MOVEMENT REQUIREMENTS
ARMORED DIVISION

Minimum Containerization				
All FSS*	8.00	1.93		
FSS and Cape H	6.69	3.00		
All Breakbulk			37.88	
Maximum Containerization				
FSS and Container	7.95			2.00
FSS, Cape H, and Container	4.67	3.00		2.00
Breakbulk and Container			29.61	2.00

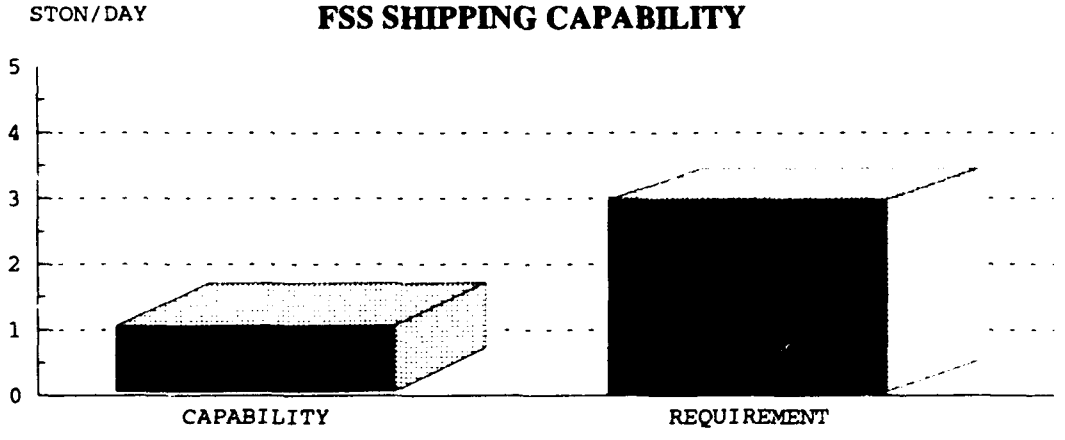
*Only eight FSS are available. Unit shipping requirements exceed the capacity of these eight vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

Legend:

RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, Aug 91.



SUMMARY

The berthing restrictions of the FSS vessels limit the Port of Galveston to one FSS vessel support system. This will support the deployment of one armored brigade (one-third division) over a 6-day (three FSSs at 2 days per ship) outloading period.

RECOMMENDATIONS

1. Designate only one brigade of equipment to deploy through the Port of Galveston, because of berth limitations.

2. Designate berth 10 and 8 acres of adjacent open staging area to support the one FSS-loading

PORT OF GULFPORT

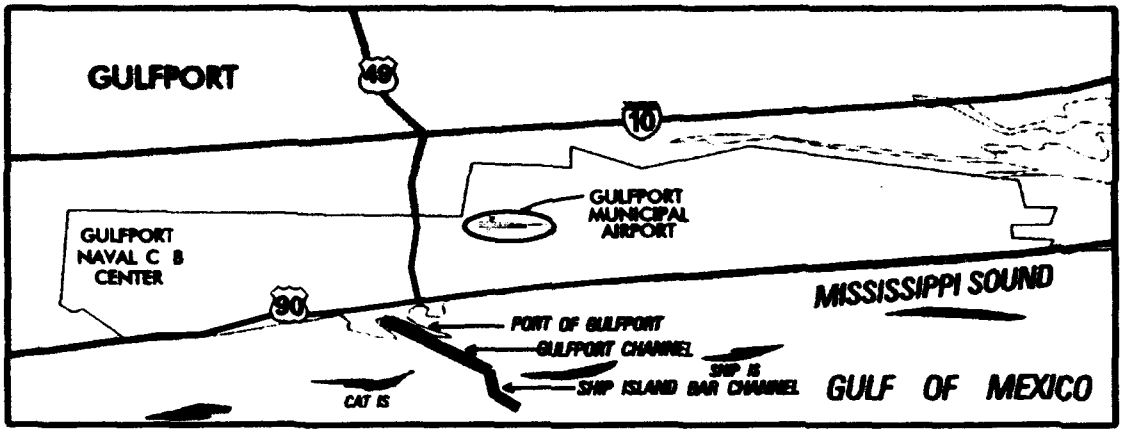
GULFPORT, MISSISSIPPI

I. GENERAL DATA

TRANSPORTATION ACCESS

WATER

The Port of Gulfport, Mississippi, is on the Mississippi Sound, in the southeast portion of the State. The port is between Mobile, Alabama, and New Orleans, Louisiana. It is about 19 miles from the deepwater of the Gulf of Mexico.



Water Access

A series of barrier islands separate the Mississippi Sound from the Gulf of Mexico. The two main islands south of Gulfport are Ship and Cat.

Gulfport Harbor consists of a manmade, rectangular-shaped basin. Two parallel piers (west and east), spaced about one-quarter mile apart and extending three-quarters mile into the Mississippi Sound, form the basin.

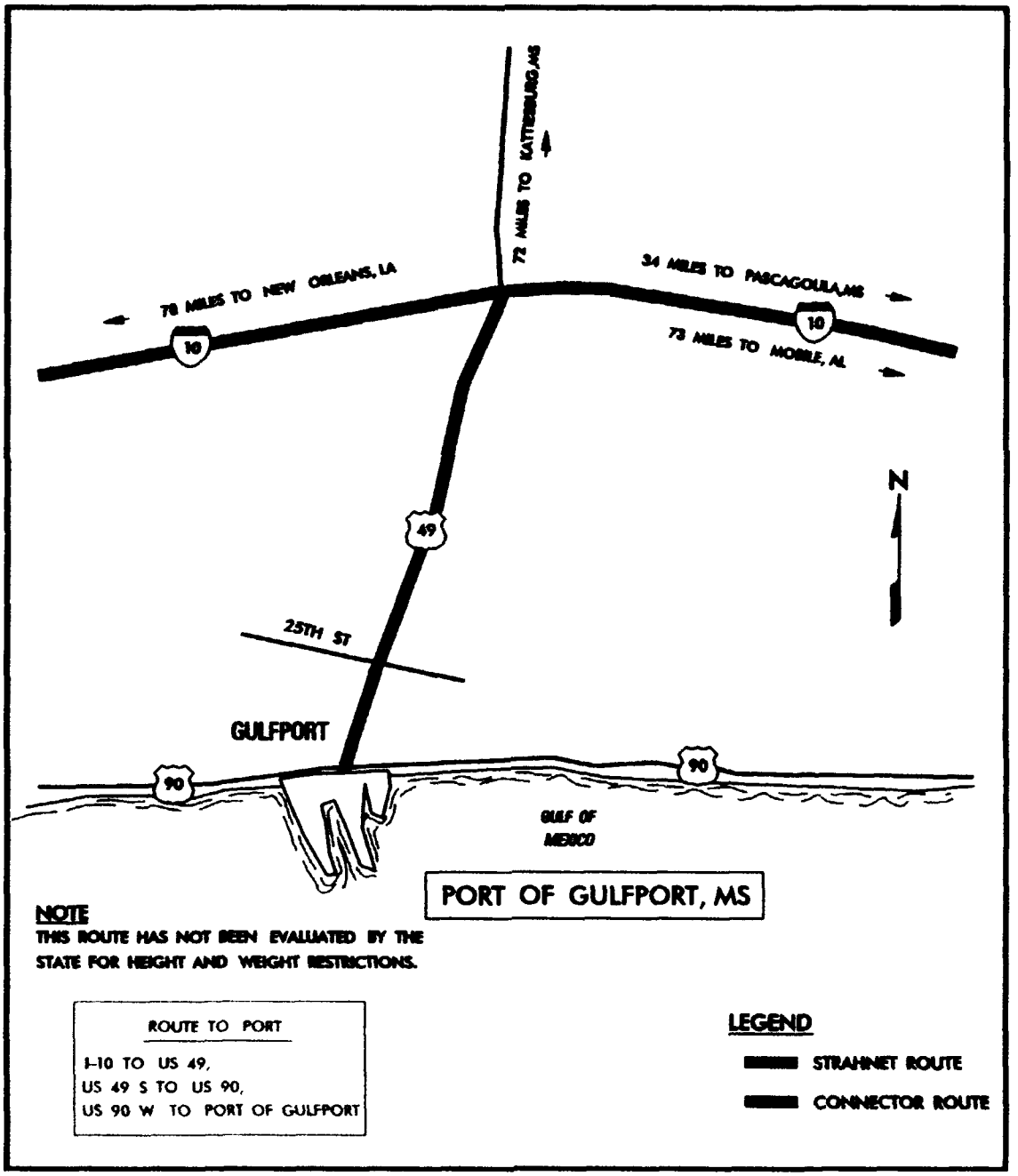
Passage from the Gulf of Mexico to the Port of Gulfport is via two channels: Ship Island Bar Channel and Gulfport Channel. The Ship Island Bar Channel provides passage from the Gulf of Mexico to the Mississippi Sound. The channel is 300 feet wide, 32 feet deep mean low water (MLW), and about 7 miles long. Access to the harbor basin through the Mississippi Sound is via the Gulfport Channel. This channel extends across the Mississippi Sound for about 10 miles, leading into the harbor basin. It is 220 feet wide by 30 feet deep MLW.

Within the harbor basin is a 1,320-foot diameter by 30-foot-deep mean low water (MLW) turning basin. According to Navy standard operating procedures, ships do not normally turn in an area that is less than 1.5 times their length. Based on this guideline, ships more than 880 feet will not normally use this basin.

No bridges cross any of the ship channels leading to the Gulfport harbor basin. Also, no other overhead clearance restrictions are along these ship channels.

HIGHWAY

Two main gates provide access to the port. From US Route 90, the 30th Avenue (to West Pier Gate) and 27th Avenue (to East Pier Gate) extensions provide direct access to the port. Two additional private gates (Chiquita and Dole Gates) are off the 30th Avenue and 27th Avenue extensions, respectively. These gates are used for the import of bananas and other fruit. Although not normally available to the military, the Army may be able to arrange for use of these gates to support military operations in emergency situations. One block west of the port, US Route 49 intersects US 90. US 49 provides access to Interstate Routes 10, 20, and 59 and US Routes 98 and 84.



Highway Access

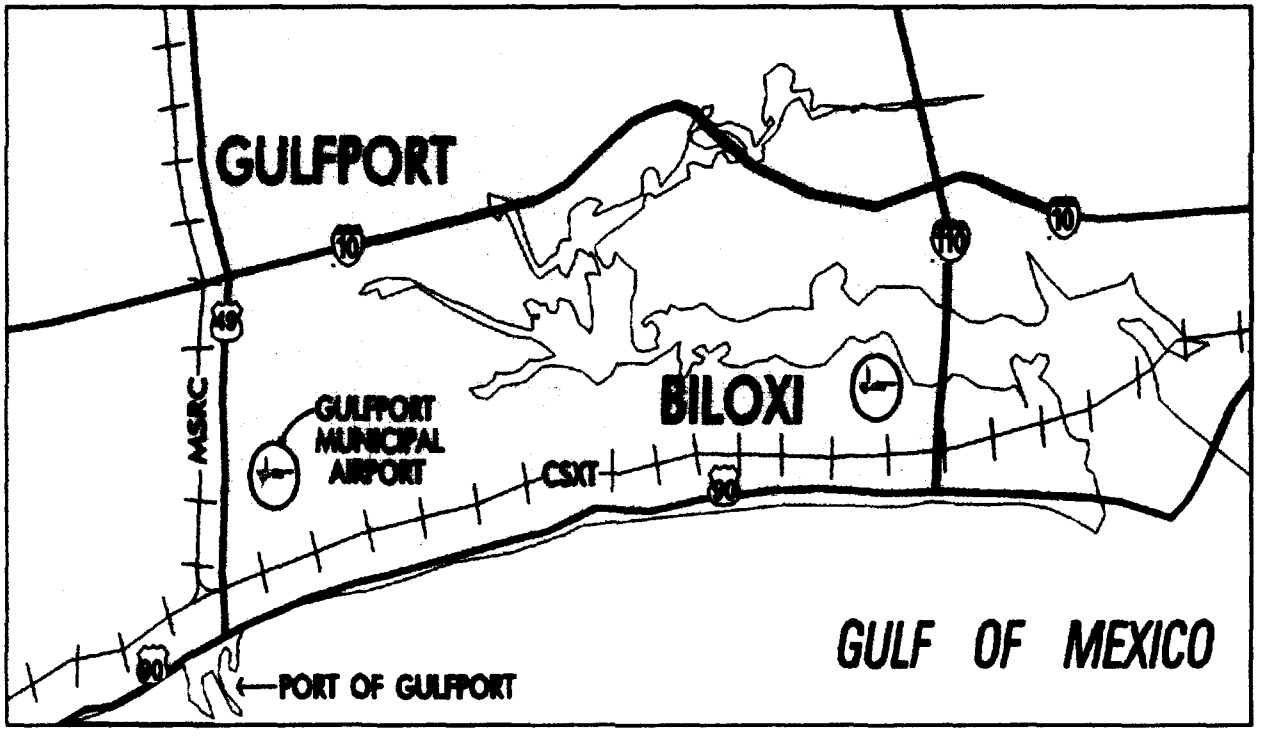
RAIL

Mid-South Rail Corporation provides one track to each of the two piers at the Port of Gulfport. The port has no rail switching yards. About 1.25 miles from the port is a Mid-South Rail Corporation railyard with an 800-railcar capacity. The port owns and operates a trackmobile for railcar placement within port areas.

AIR

Two airports, one commercial and one military, are within service range of the Port of Gulfport. The Gulfport-Biloxi Regional Airport is about 3.8 miles northeast of the port. It has two asphalt runways. One runway is 9,000 feet long by 150 feet wide. The other runway is 5,000 feet long by 150 feet wide.

Keesler Air Force Base is about 13 miles east of the port. It has one asphalt runway, which is 5,030 feet long by 150 feet wide.



Rail and Air Access

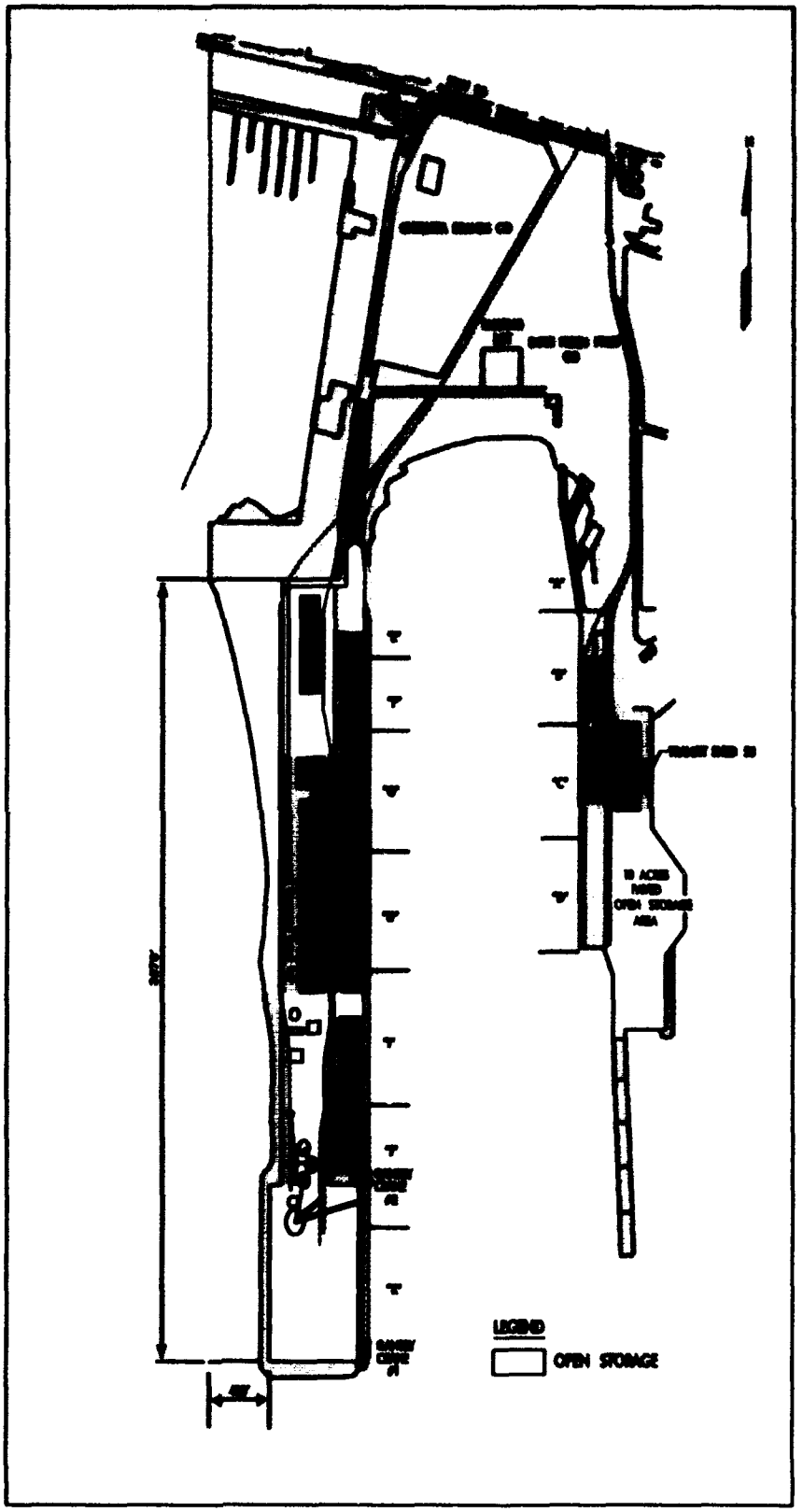
PORT FACILITIES

BERTHING

Two piers, east and west, provide 11 berths. The east pier (berths A through D) has 2,060 feet of continuous berthing space. The west pier (berths E through K) has 3,740 feet of continuous berthing space. Individual berths range in length from 330 to 600 feet. Apron width varies from 30 feet to open. Apron height ranges from 10 feet above MLW at berths A through C on the east pier to 11 feet above MLW at all other piers. The depth alongside all the berths is 30 feet MLW. The deck strength for berths A through E and I through K is 1,000 pounds per square foot. Berths F through H have a deck strength of 750 pounds per square foot. Transit sheds support one-half of berth B and berths C and E through J.

Pier construction is mostly concrete decking supported by concrete piles. Some portions of the pier have concrete decking supported by steel sheet piles with earth backfill. All berths have a timber fendering system.

Lighting is very good for night operations.



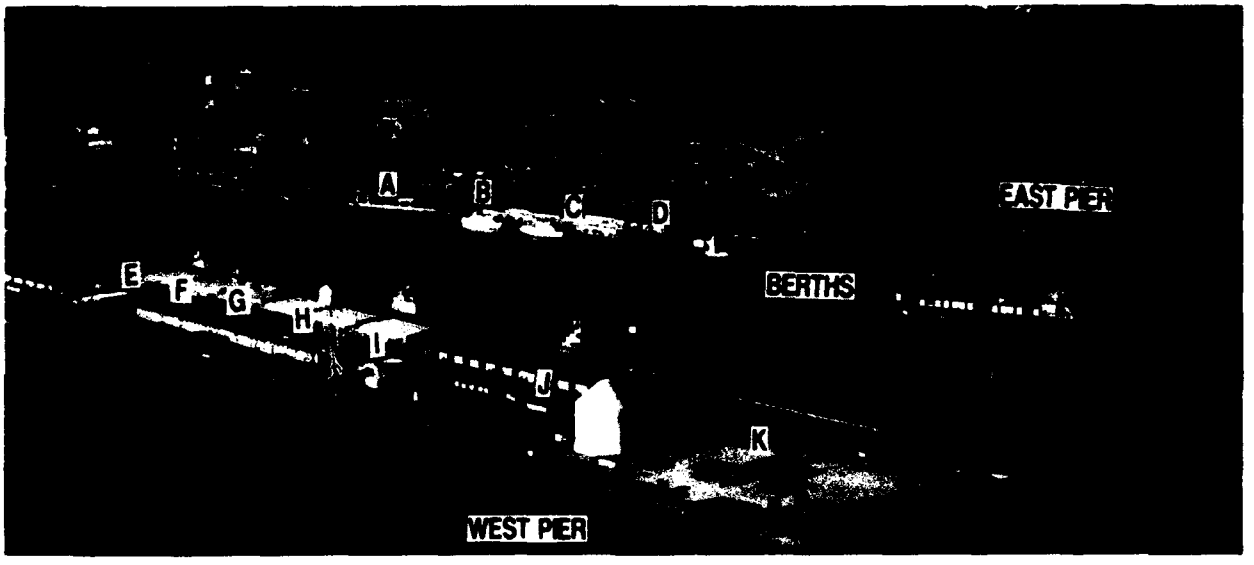
Site Map

BERTH CHARACTERISTICS

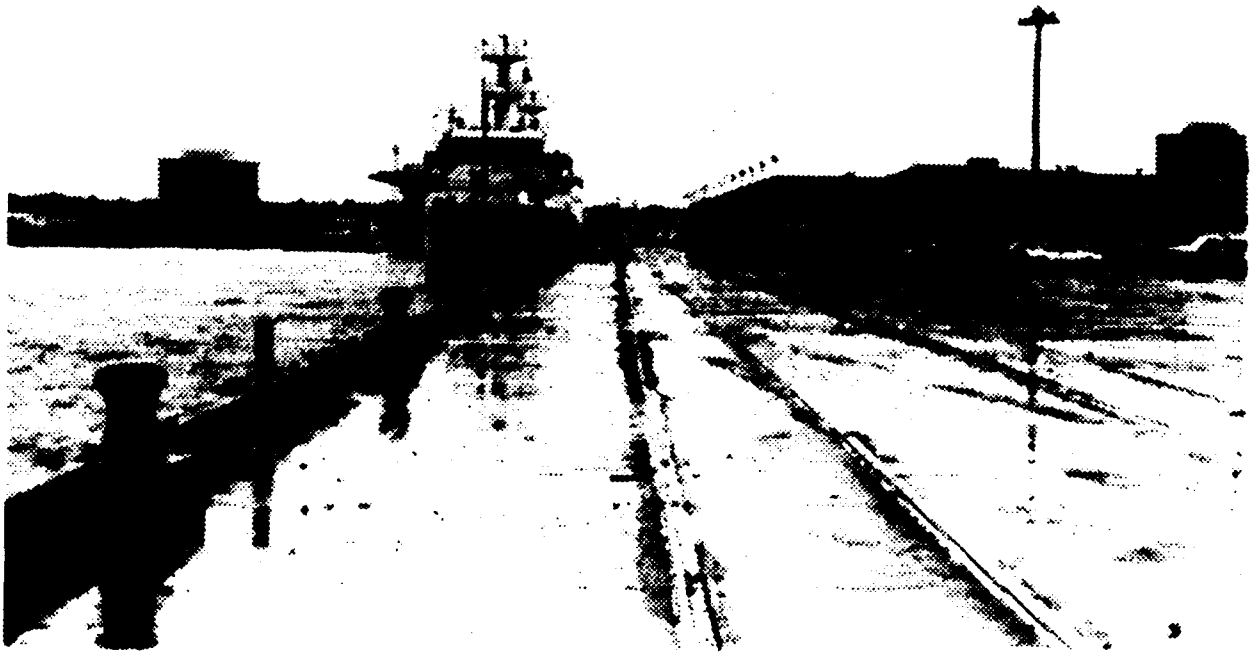
Length (ft)	530	1,020	510	520	1,430	1,190	600
Depth alongside at MLW (ft)	30	30	30	30	30	30	30
Deck strength (psf)	1,000	1,000	1,000	1,000	750	1,000	1,000
Apron width (ft)	30	40	Open	Open	44	63	Open
Apron height above MLW (ft)	10	10	11	11	11	11	11
Number of container cranes	0	0	0	0	0	0	2
Number of wharf cranes	0	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stem RORO facilities	No	No	No	No	No	No	No
Apron length served by rail (ft)	0	1,020	510	520	1,430	1,190	600

NOTES:

1. Terminal open storage area is 30 acres.
2. Terminal covered storage area is 336,960 square feet.



Port Facilities



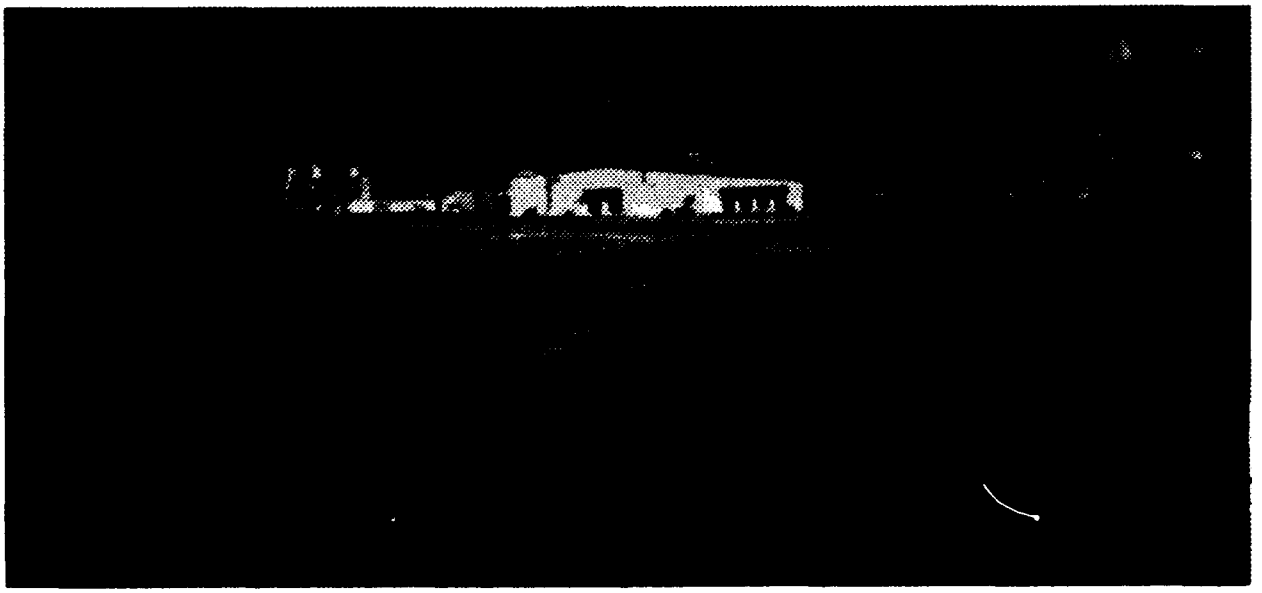
East Pier, Berths A - D

West Pier, Berths E - K

STAGING

Open Storage

The Port of Gulfport has about 41 acres of open storage. About 31 of these acres are paved or shell. Ten acres of paved open storage is behind berth D and part of berth C. The remaining 21 acres of paved open storage is on the west pier. The 10 acres of undeveloped land is north of the port.



Open Storage Behind Berth D

Open Storage Area on West Pier

The open storage is mainly used for containers, lumber, forest products, rolling stock, and general cargo. United Brands Company has an additional 15 acres of paved open storage under lease.

The open storage areas at the end of the west and east piers are the only possible locations for helicopter operations within the port.

Covered Storage

The Port of Gulfport has 11 transit or backup sheds. Nine and one-half transit/backup sheds provide 336,960 square feet of covered storage for general cargo. The other 1.5 transit sheds provide 103,160 square feet of refrigerated covered storage. In general, the refrigerated covered storage and associated truck and rail docks are not available for military use. However, if needed, the Army can arrange for use of these facilities provided they are available.

COVERED STORAGE

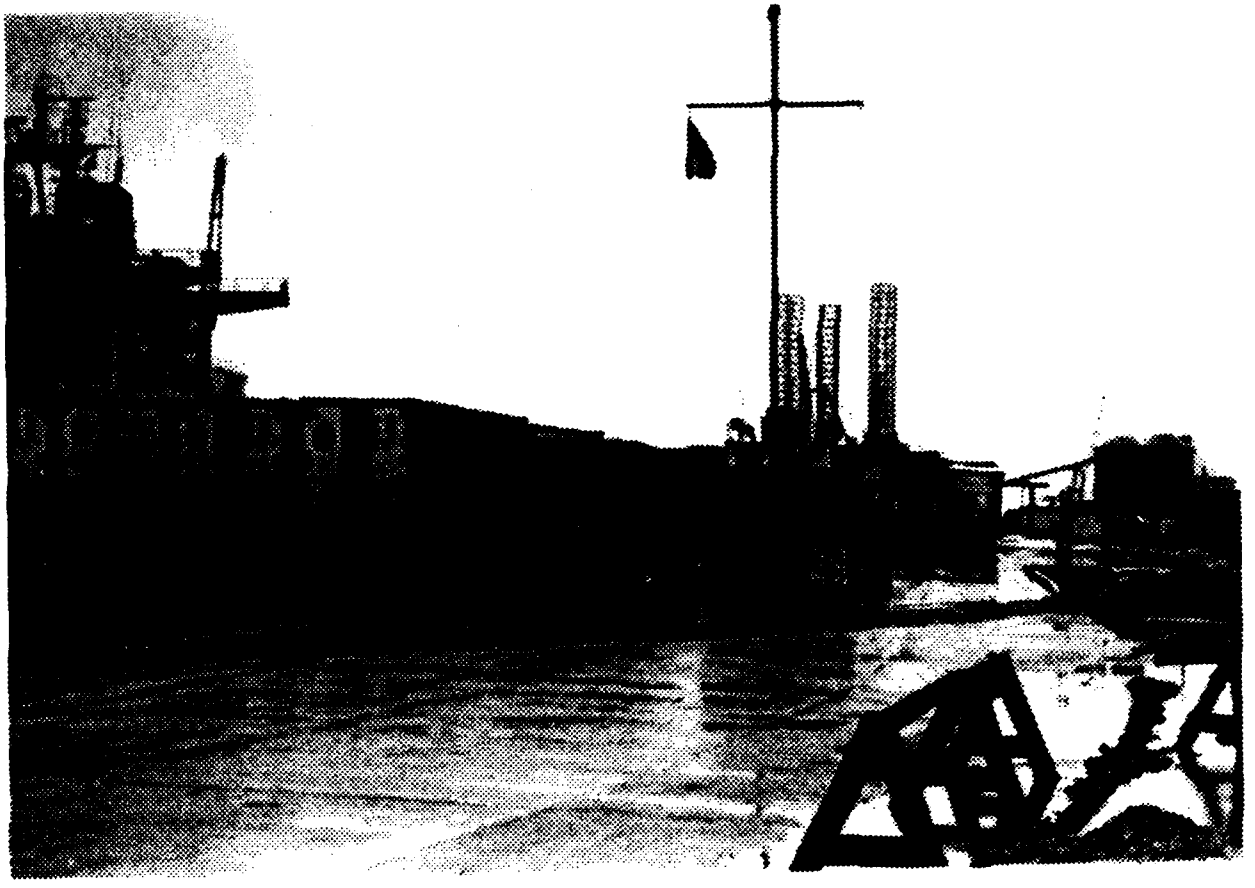
Shed 1	0	10	or	3	Torn Down
Shed 2	12,100	20	or	3	General Cargo
Shed 3	24,200	20	or	3	General Cargo
Shed 4	24,200	20	or	3	General Cargo
Shed 5	24,200	0		3	General Cargo
Shed 6	24,200	0		3	General Cargo
Shed 7	24,200	0		3	General Cargo
Shed 8	24,200	0		3	General Cargo
Shed 14	96,320	80	or	12	50% Refrigerated 50% General Cargo
Shed 15	55,000	40	or	6	Refrigerated Cargo
Shed 52	71,500	8	or	10	General Cargo
Shed 53	60,000	12	or	12	Backup

RAIL

Mid-South Rail Corporation provides two apron tracks on both the west and east piers. There are rail spurs behind all of the transit and backup sheds. All of the transit and backup sheds have railcar-level platforms. These platforms provide 64 railcar handling positions. Rail trackage links the apron tracks and rail spurs to the two rail lines coming into the port. Container-on-flatcar (COFC) and trailer-on-flatcar (TOFC) operations are conducted at the west pier open storage areas. The Mid-South Rail Corporation railyard located 1.25 miles from the port can store 800 railcars.

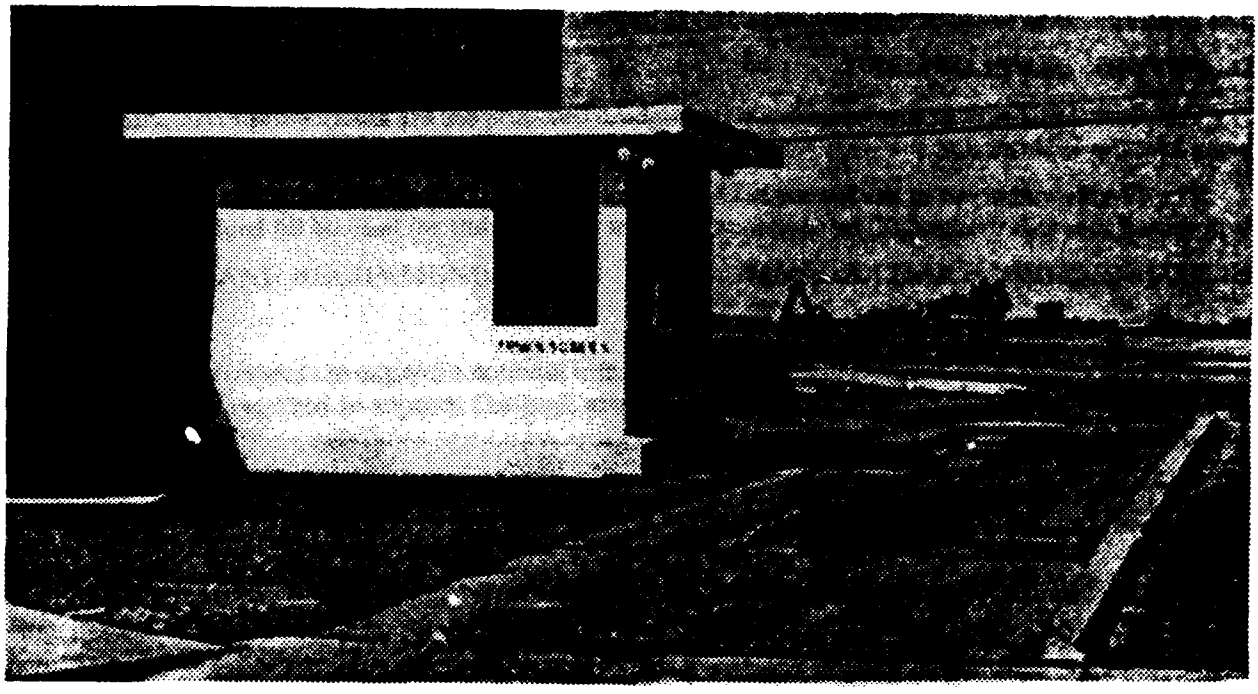
HIGHWAY

Access to the west pier by commercial truck traffic is by way of the 30th Avenue Extension. Access to the east pier is via the 27th Avenue Extension. Berth roads are two lanes and asphalt paved. Entry to the piers is by way of two-lane manned gates. The west pier has a 52-ton truck scale. This scale is on the main roadway leading to the container marshaling areas and backup sheds.



Thirtieth Avenue Extension Gate

Twenty-Seventh Avenue Extension Gate



Truck Scales (West Pier)

UNLOADING/LOADING POSITIONS

Ramps

The east pier has a concrete truck end ramp at berth D. This ramp can serve 10 trucks at one time. A wood/concrete rail end ramp is on the west pier, at the south end of transit shed 14. It has a 12-railcar loading capacity.

Docks

The transit sheds have eight truck docks. These truck-level docks provide more than 210 truck handling positions. A concrete rail side dock is on the east pier, behind the apron at berth D. This dock has a nine-railcar loading capacity. Because the truck and rail docks share some of the handling positions, not all of the truck or rail handling positions are available at the same time. Also, 80 of the truck handling positions and 12 of the railcar positions are used in conjunction with the refrigerated storage.

MARSHALING AREAS

The undeveloped tracts of land north of the piers and the United Brands Company leased area are potential marshaling areas. A Naval Construction Battalion Cen[illegible]r that could provide a substantial and secure marshaling area is about 2 miles north of the port.

MATERIALS HANDLING EQUIPMENT (MHE)

Two 30-ton Paceco container cranes (33.6 STON listed capacity) serve berths I through K at the south end of the west pier. One of these cranes is dual purpose and is capable of container, heavy-lift, or bulk operations. The time required to convert this crane to a particular operation is 30 minutes. No portable RORO or fixed stern ramps serve the port.

Heavy-lift equipment, as well as any mobile assets, is readily available from stevedoring firms within 24 hours' notice. Mobile land and floating cranes range in capacity from 100 to 200 tons.

MATERIALS HANDLING EQUIPMENT
(Port of Gulfport)

Mobile crane	65	1
Mobile crane	40	1
Mobile wharf crane	25	1
Forklift	10	2
Forklift	6	8
Forklift	4	41
Forklift	3.5	8
Forklift	2.5	5
Forklift, electric	3.5	12
Forklift, electric	3	7
Front end loader	NA	8
Container tractor	NA	12

Port of Gulfport Container Crane

INTERMODAL FACILITIES

The Port of Gulfport has a limited intermodal capability. The closest dedicated intermodal railyards to the Port of Gulfport are in New Orleans, Louisiana, and Mobile, Alabama. The companies providing intermodal service in the New Orleans area are the CSX, Illinois Central, Kansas City Southern, Norfolk Southern, Southern Pacific, and Union Pacific Railroads. The companies providing intermodal service in Mobile are Illinois Central Gulf, CSX, Burlington Northern, and Norfolk Southern.

FUTURE DEVELOPMENT

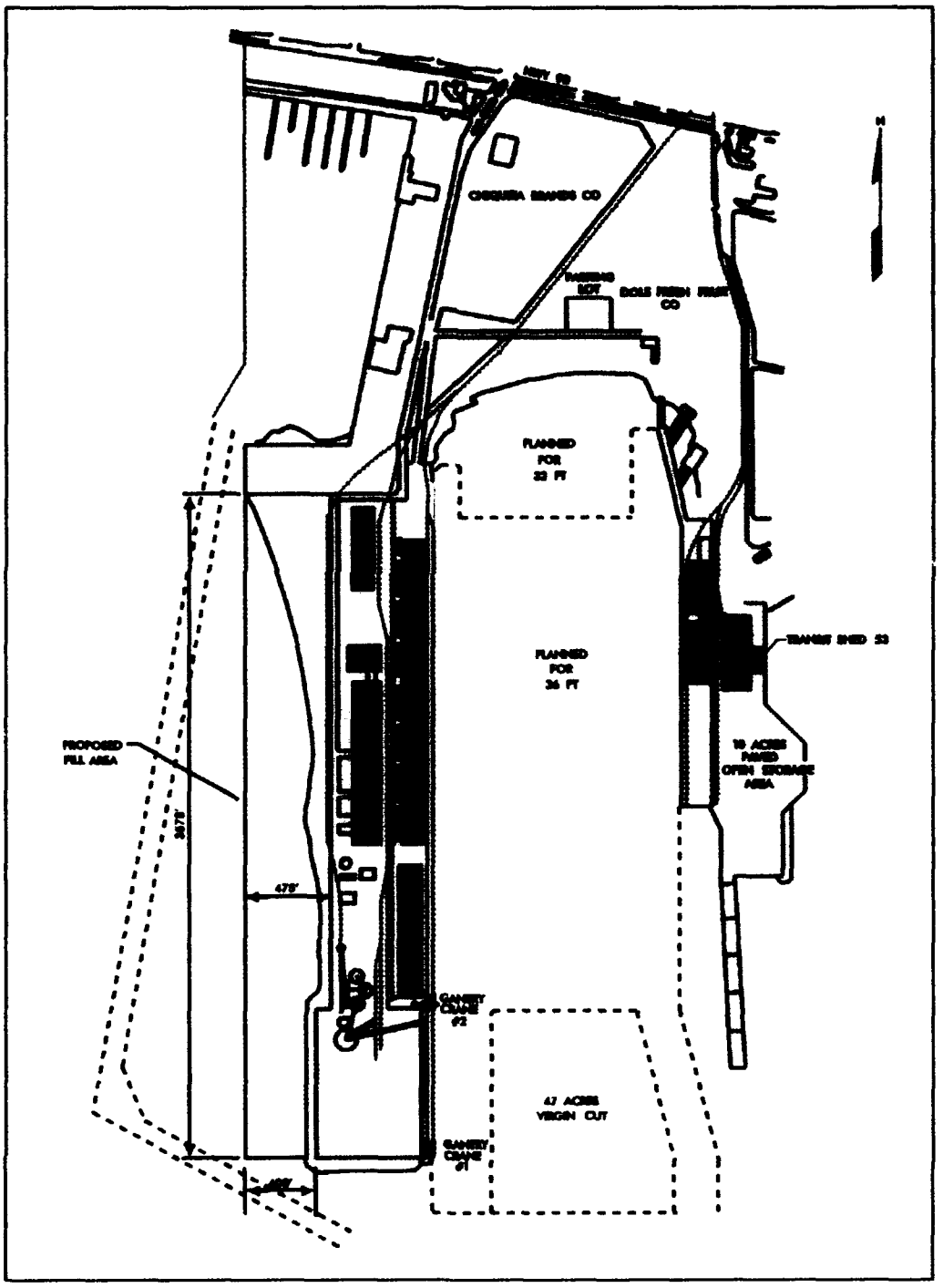
Several maintenance projects such as rail rehabilitation, roof repairs, and dock resurfacing are underway or have been completed.

The most significant improvements are the proposed dredging of the channel and entrance to the harbor basin and the expansion of the west pier. The scheduled completion date is 1 December 1993.

During dredging operations, 47 acres of virgin cut in the harbor basin will provide about 1.47 million cubic yards of fill material. This dredged material will be used as fill for the 29-acre expansion project of the west pier container area.

The Ship Island Bar Channel will be dredged to 38 feet and the Gulfport Channel and Gulfport Harbor will be dredged to 36 feet.

Sheds 1, 2, 9, 10, 11, and 12 and half of shed 3 were torn down. The port authority plans to convert these areas into open storage for containers.

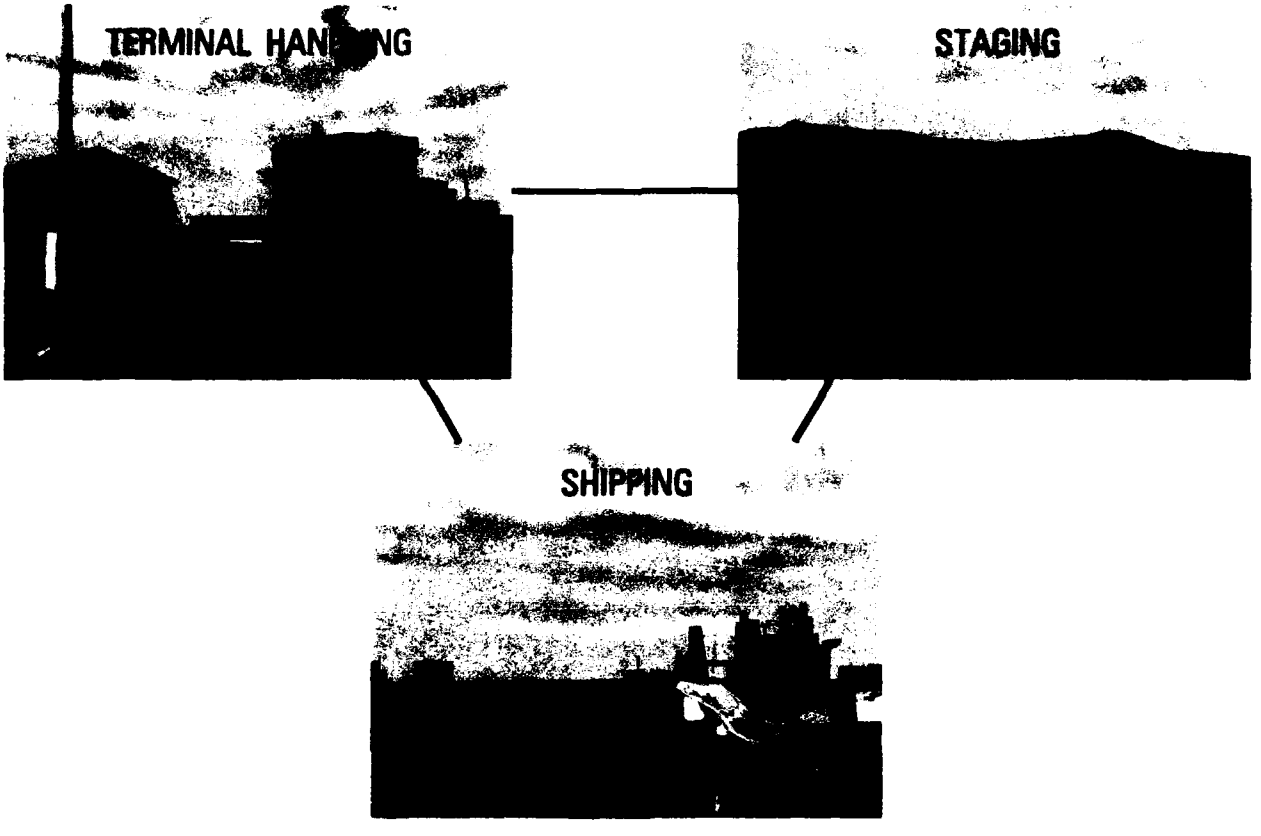


Dredging and Expansion of Port of Gulfport

II. THROUGHPUT ANALYSIS

GENERAL

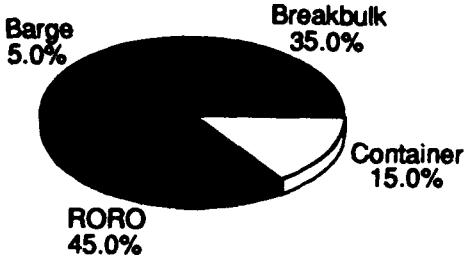
We evaluated the theoretical throughput capability of the Port of Gulfport using the port operational performance simulator (POPS) computer model. The POPS model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least-capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/ handling - in short tons (STON) and measurement tons (MTON) per day.



Terminal Throughput Subsystems

The analysis assumes that 80 percent of the port facilities will support the military deployment. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.

SHIP MIX PERCENTAGES



TERMINAL RECEPTION/HANDLING

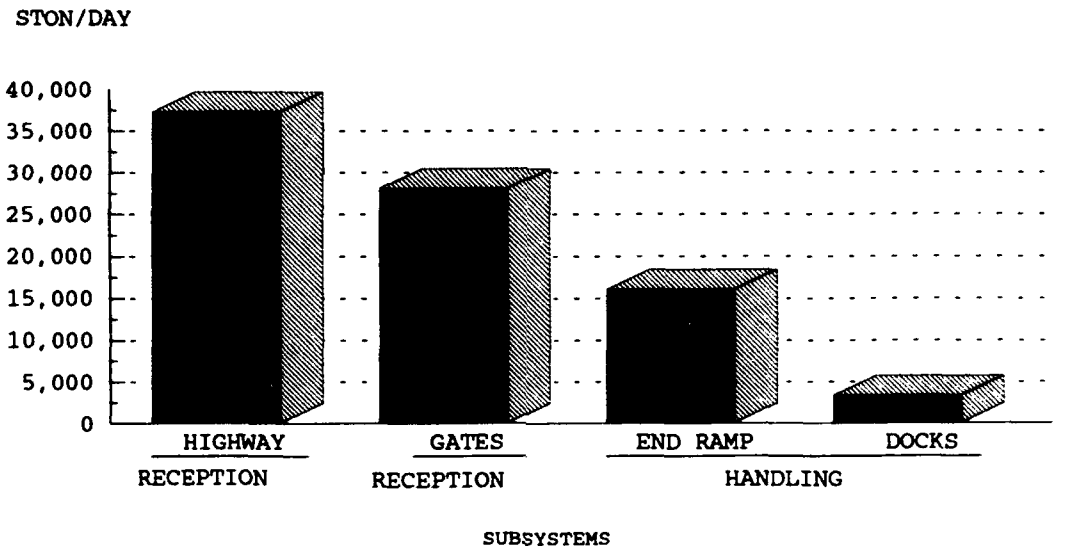
HIGHWAY

From US Route 90, the 30th and 27th Avenue extensions provide direct access to the port. These two port roadways provide access to staging and pier areas. The gate reception capability of these two roadways could handle almost 28,000 STON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to staging areas. Vehicles on commercial or military flatbed trailers not equipped with a means for unloading vehicles can offload at the truck end ramp on the east pier. This ramp could offload about 16,000 STON per day. Van semitrailers carrying supplies will proceed to transit shed docks not occupied by railcars for offloading.

For this study, we assumed that railcars would occupy the truck/railcar docks on the west pier because the railcar end ramp is on that pier. Therefore, we analyzed van semitrailers offloading on the east pier because the truck end ramp is on the east pier. The 20 truck dock handling positions on the east pier could handle almost 3,300 STON of cargo per day. Although the Port of Gulfport has a limited container handling capability, it does not have a dedicated intermodal railyard.

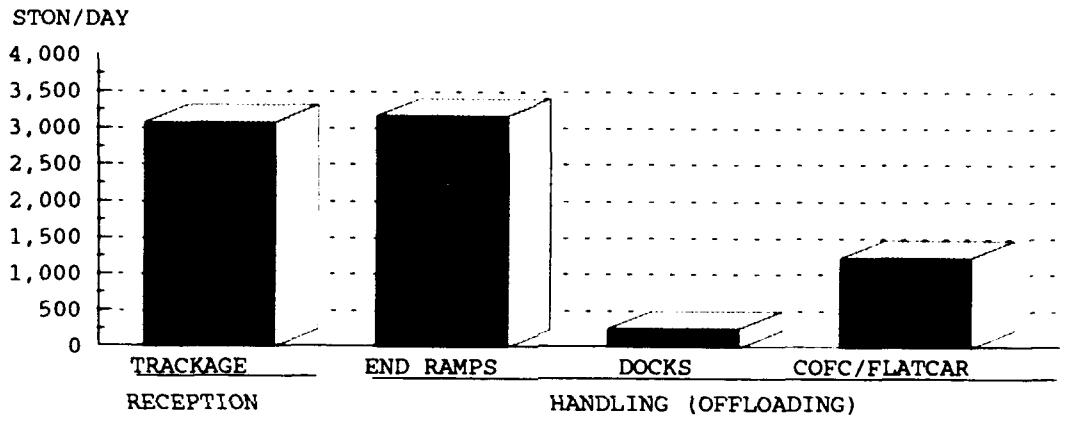
HIGHWAY RECEPTION/HANDLING CAPABILITY



RAIL

The Port of Gulfport has two railroad tracks running along the wharf, allowing direct transfer of cargo from railcar to ship. Also, rail spurs are behind all the transit and backup sheds. All the sheds have railcar-level platforms, allowing offloading of boxcars. These platforms provide 64 railcar handling positions. The Port of Gulfport has a railcar end ramp on the west pier that serves 12 railcars at one time. This allows vehicles to offload circus style. Because of this ramp, we assumed that rail traffic could be routed to the west pier, allowing offloading of vans and semitrailers on the docks and at the truck end ramp on the east pier. Current rail service to the port is two trains a day.

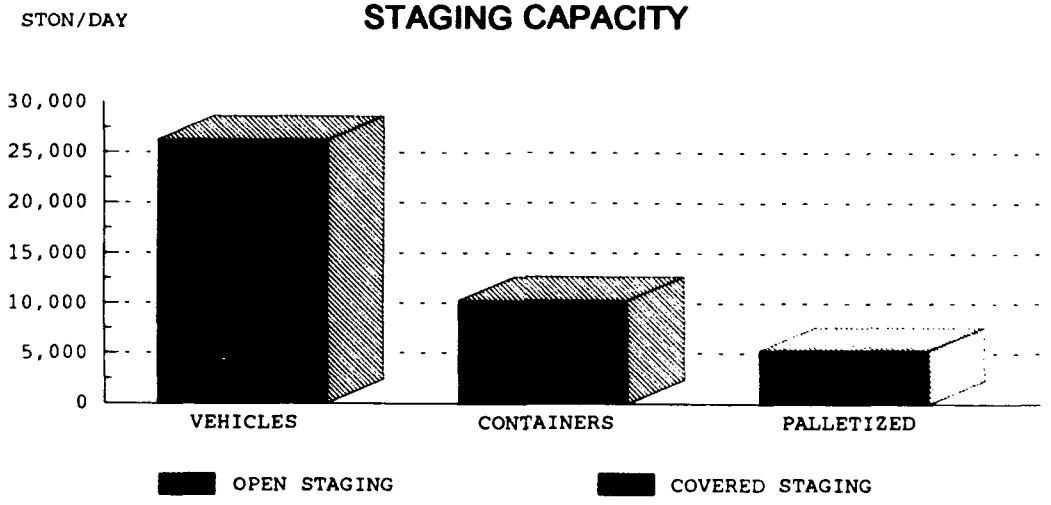
RAIL RECEPTION/HANDLING CAPABILITY



STAGING

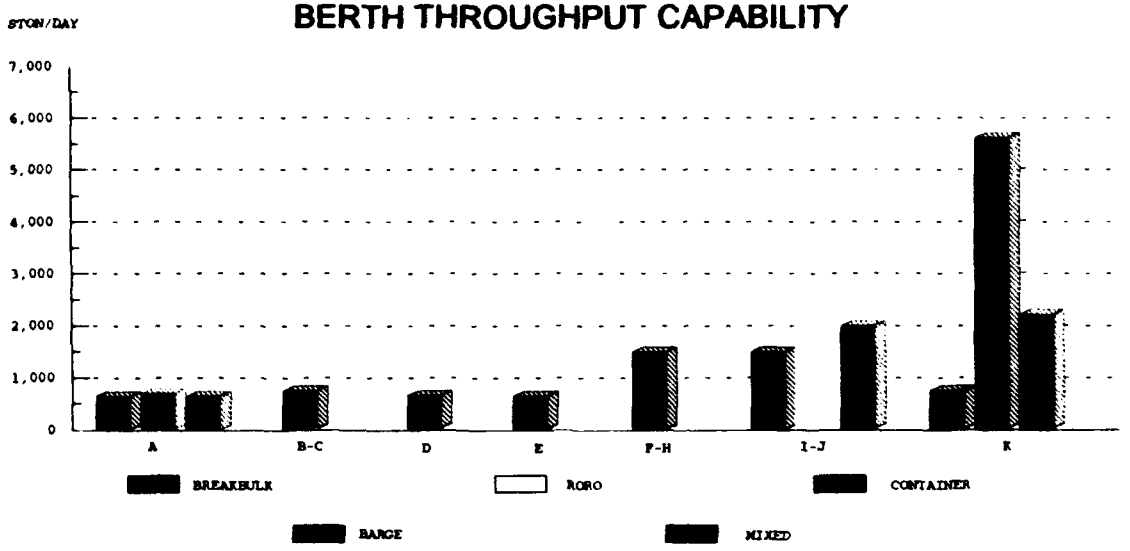
The Port of Gulfport has about 31 acres of paved open storage for vehicles and/or containers. This staging area can store about 23,230 STON of breakbulk cargo and 3,000 STON of rolling stock (26,230 STON total), and 10,350 STON of containers. Also, about 336,960 square feet of covered storage provides protection for about 5,400 STON of palletized cargo.

STAGING CAPACITY



SHIPPING

The figure shows the throughput capability per berth in STON per day for breakbulk, RORO, container, and mixed vessels. These results were based on various factors, including MHE used, loading, operational, and berth utilization rates, as well as berth/ship compatibility.



The berth/ship compatibility for various vessel types is shown in the table 1. This appendix shows for each type of ship, the number of vessels that can be accommodated at each berth. The table also provides the limitations that can hinder shipping operations.

The type of ship preferred at each berth is based on methodology that compares the characteristics of the ship berth to a list of ideal factors required to support the different ship mixes. The evaluation takes into consideration the current physical characteristics and MHE available for a berth. This evaluation gives no considerations for enhancements, such as equipment.

Berth K provides the largest throughput capability for container vessels. Berth I-J provides the largest throughput capability for RORO and breakbulk operations.

PREFERENCE BERTH SELECTION

Breakbulk	6	2	6	2	4	1	5
RORO	-	-	-	-	-	1	-
Container	-	-	-	-	-	-	1
Barge	1	-	-	-	-	-	-

NOTE: Berths marked "-" are not recommended for these operations.

TABLE 1
SUMMARY OF GULFPORT BERTHING CAPABILITIES

Breakbulk							
C3-S-33a	a,g	a,g	a,g	a,g	a,g	a,g	a,g
C3-S-37c	a,g	a,g	a,g	a,g	a,g	a,g	a,g
C3-S-37d	1	1	1	1	2	2	1
C3-S-37a	1	1	1	1	2	2	1
C4-S-1a	c	1	c	c	2	2	1
C4-S-1qb and 1u	a,c,g	a,g	a,c,g	a,c,g	a,g	a,g	a,g
C4-S-58a	a,c,g	a,g	a,c,g	a,c,g	a,g	a,g	a,g
C4-S-65a	c	1	c	c	2	2	1
C4-S-66a	a,c,g	a,g	a,c,g	a,c,g	a,g	a,g	a,g
C4-S-69b	a,c,g	a,g	a,c,g	a,c,g	a,g	a,g	a,g
Seatrain							
GA and PR-class	c	1	c	c	2	2	1
Barge							
LASH C8-S-81b	a,c,g	a,g	a,c,g	a,c,g	a,g	a,g	a,c,g
LASH C9-S-81d	a,c,g	a,g	a,c,g	a,c,g	a,g	a,g	a,c,g
LASH lighter	3	7	3	3	10	8	4
SEABEE C8-S-82a	a,c,g	a,g	a,c,g	a,c,g	a,g	a,g	a,c,g
SEABEE barge	2	5	2	2	7	5	3
RORO							
Comet	d,o	d,o	d,i,j	d,i,j	d,o	d,o	d,i,j
C7-S-95a/Maine-class	a,b,c,g	a,b,g	a,c,g	a,c,g	a,b,g	a,g	a,c,g
Ponce-class	b,c,h	b,h	c,h	c,h	b,h	b,h	c,h
Great Land-class	b,c,h	b,h	c,h	c,h	b,h	b,h	c,h
Cygnus/Pilot-class	b,c	b	c	c	b	1	c
Meteor	c,d,o	d,o	c,d	c,d	d,o	d,o	d,i,j
AmEagle/Condor	b,c	b	c	c	b	i,j	c
MV Ambassador	c,d,o	d	c,d	c,d	d	d	d
FSS-class	a,b,c,g	a,b,g	a,c,g	a,c,g	a,b,g	a,g	a,c,g
Cape D-class	a,b,c,g	a,b,g	a,c,g	a,c,g	a,b,g	a,g	a,c,g
Cape H-class	a,b,c,g	a,b,g	a,c,g	a,c,g	a,b,g	a,g	a,c,g
Container							
C6-S-1w	c,e	1,e	c,e	c,e	2,e	1,e	c
C7-S-68e	a,c,e,g	a,e,g	a,c,e,g	a,c,e,g	a,e,g	a,e,g	a,c,g
C8-S-85c	a,c,e,g	a,e,g	a,c,e,g	a,c,e,g	a,e,g	a,e,g	a,c,g
Combination							
C5-S-78a	a,c,e,g	a,e,g	a,c,e,g	a,c,e,g	a,e,g	a,e,g	a,c,g
C5-S-37e	c,e	1,e	c,e	c,e	2,e	1,e	1

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum bessel draft.

( ) indicates vessels assigned by analyst

Note: Although a particular berth may show an inadequate berth length, the vessel may extend into an adjacent berth to allow bar usage.

III. APPLICATION

GENERAL

This section of the report will evaluate the port's throughput capability for deploying a notional mechanized infantry brigade using primarily FSS vessels.

The analysis will use only those facilities designated in the *Planning Orders Digest*, issued by MARAD. These orders call for the Port of Gulfport to grant exclusive use of certain facilities before and during national emergencies. These facilities include the "West Pier Dry Bulk and Container Wharf and 10 acres of paved open storage; West Pier Cold Storage Wharf and truck marshaling yard; and West Pier North Wharf, open storage west of North Wharf, and transit shed."

FACILITIES PLANNED FOR MILITARY USE

(SEE FIGS)

E	Open storage west of North Wharf west pier (about 6 acres)
I - J	Truck marshalling yard (about 1 acre)
K	10 acres paved open storage
	Common area north of the port (about 10 acres) for marshalling

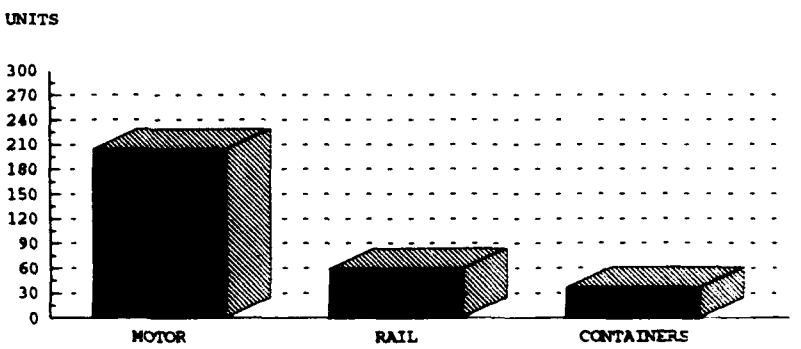
REQUIREMENTS

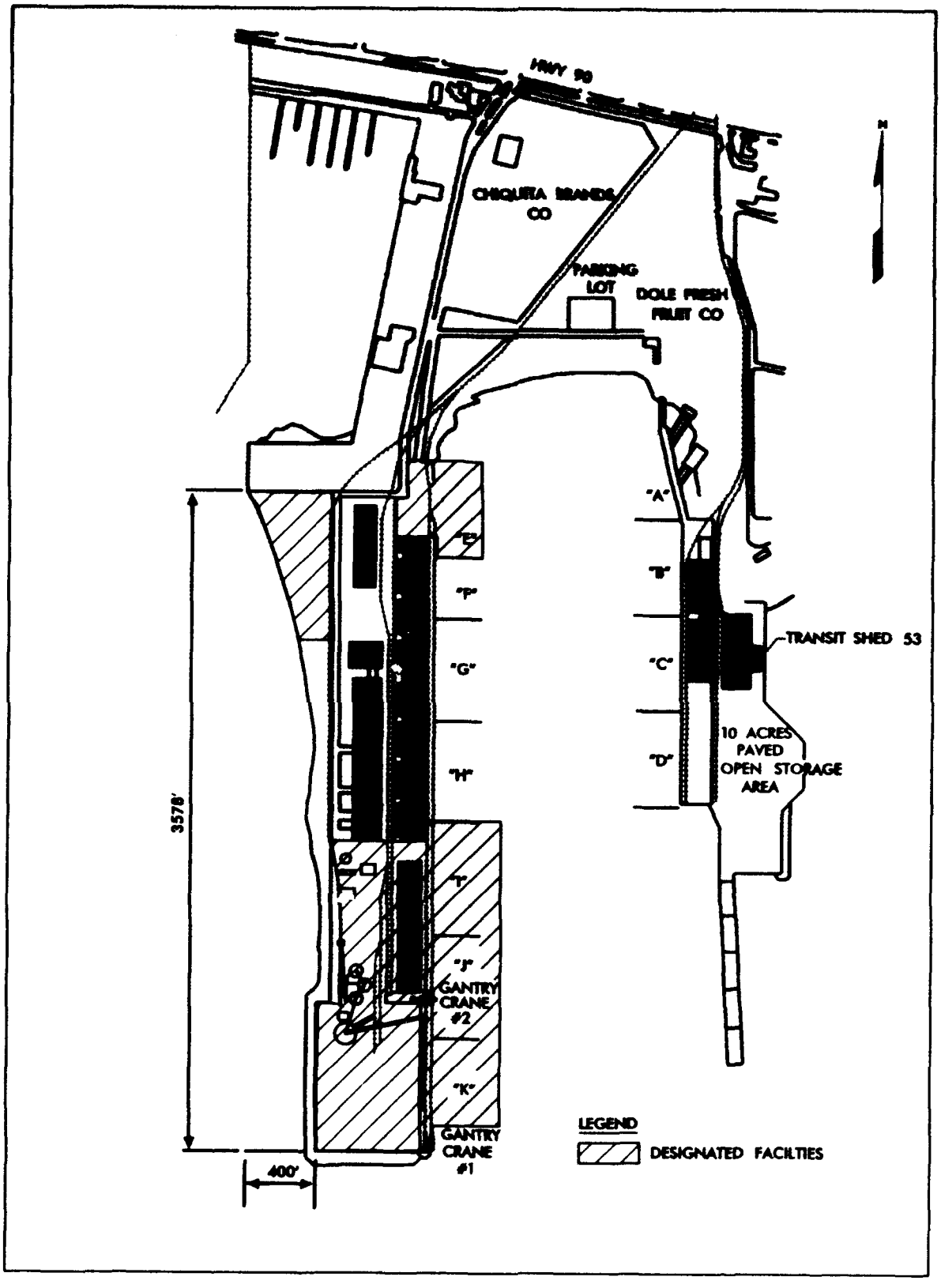
The likely requirement for the Port of Gulfport is to deploy a notional mechanized infantry brigade in 6 days. The brigade has to move about 2,600 vehicles and 220 containers. The movement of this requirement to the port will require 360 (60 per day) railcars using a convoy/rail option. Under this option, about 1,220 (205 per day) roadable vehicles would be driven and about 775 (130 per day) would be towed.

MECHANIZED INFANTRY BRIGADE DEPLOYMENT DATA

Total Equipment	
Volume	91,506 MTON
Weight	31,670 STON
Area	474,300 SQ FT
Vehicles	2,600
Containers (20 ft)	220

DAILY REQUIREMENTS CAPABILITY



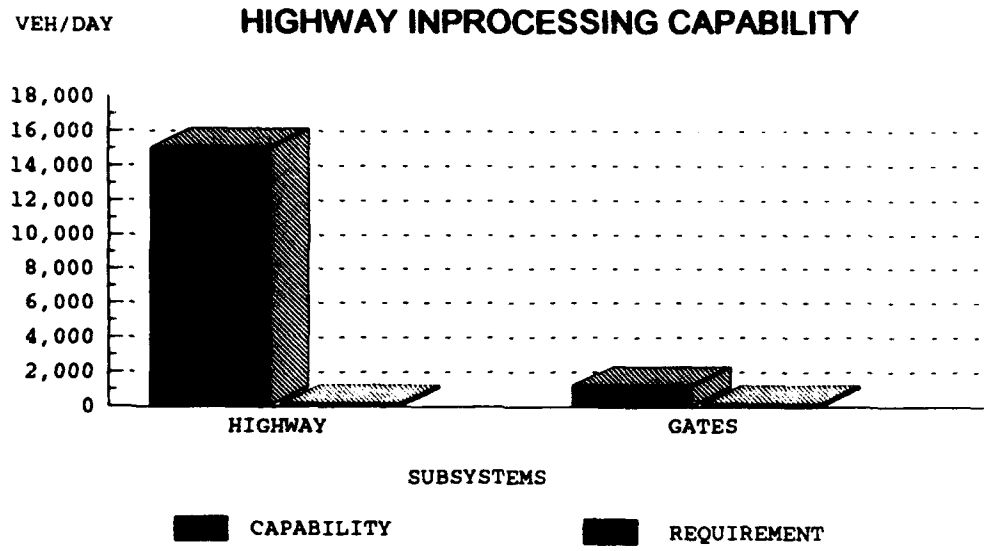


Facilities Designated for Military Use

TERMINAL HANDLING

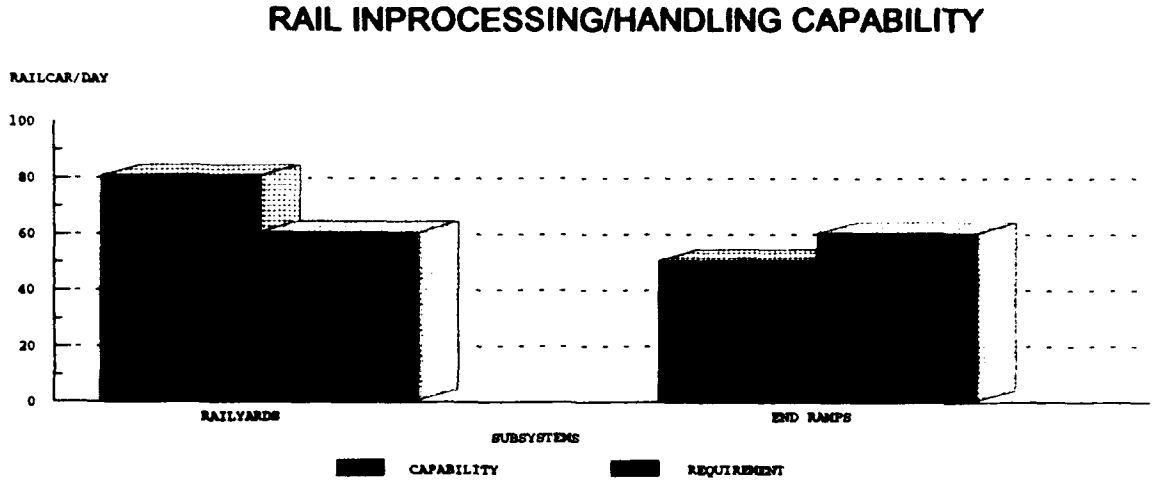
HIGHWAY

Vehicles would access the west pier through West Pier Gate on the 30th Avenue extension. Both the access road and West Pier Gate can handle at least 1,200 vehicles per day.



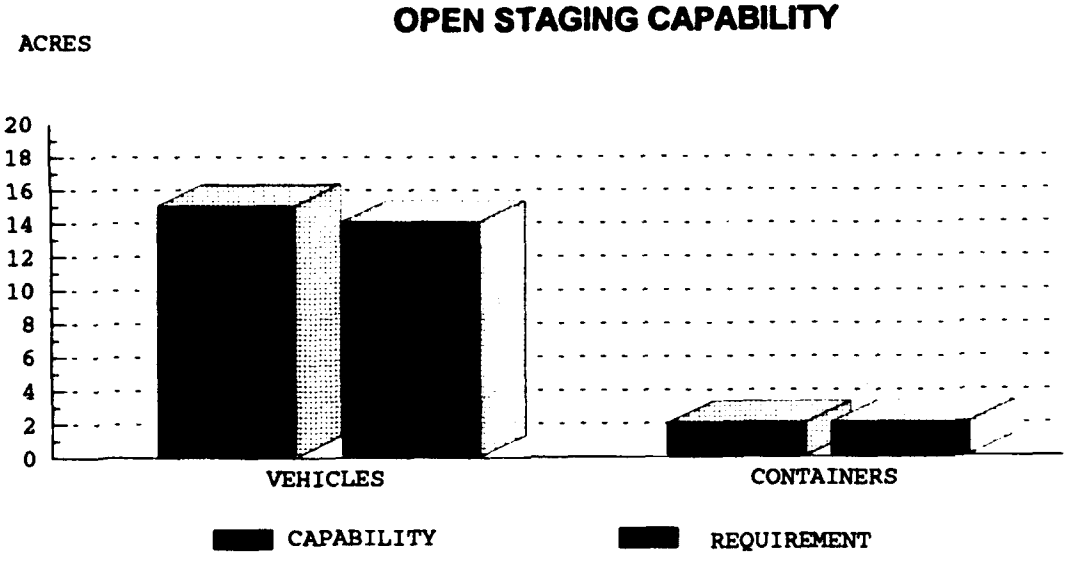
RAIL

No classification yards (classyards) are within the port. However, the port authority indicates that the port area can store about 40 railcars at one time. Current service to the port is 2 trains per day (potentially 80 railcars per day). Also, Mid-South Rail Corporation has an 800-railcar capacity rail classyard 1.25 miles from the port. At times of peak port operation, the Army may need more than the current two trains per day coming into the port from the local railyard. On the west pier is one wood/concrete railcar end ramp that can serve 12 railcars at one time. This end ramp could offload about 50 railcars per day. Since the capability does not meet the requirement, a mechanized infantry brigade may need to use the railcar side dock on the east pier, or request the port authority to obtain portable end ramps from local stevedores.



STAGING

Based on the *Planning Orders Digest* issued by MARAD, about 17 acres of paved open storage are assigned for military operations. We estimate that the Port of Gulfport needs at least 16 acres (14 acres for vehicles and 2 acres for containers) of open staging to support the sustained loading of a one FSS vessel berth system.



UNIT MOVEMENT REQUIREMENTS
MECHANIZED BRIGADE

Minimum Containerization				
All FSS*	**2.67**	**0.64**		
FSS and Cape H	**2.22**	**1.00**		
All Breakbulk			**12.57**	
Maximum Containerization				
FSS and Container	**2.64**			**0.67**
FSS, Cape H, and Container	**1.54**	**1.00**		**0.67**
Breakbulk and Container			**9.86**	**0.87**

***Only 8 FSSs are available. Unit shipping requirements exceed the capacity of these 8 vessels. Other vessel types are required to make up the FSS shortfall (Cape H).**

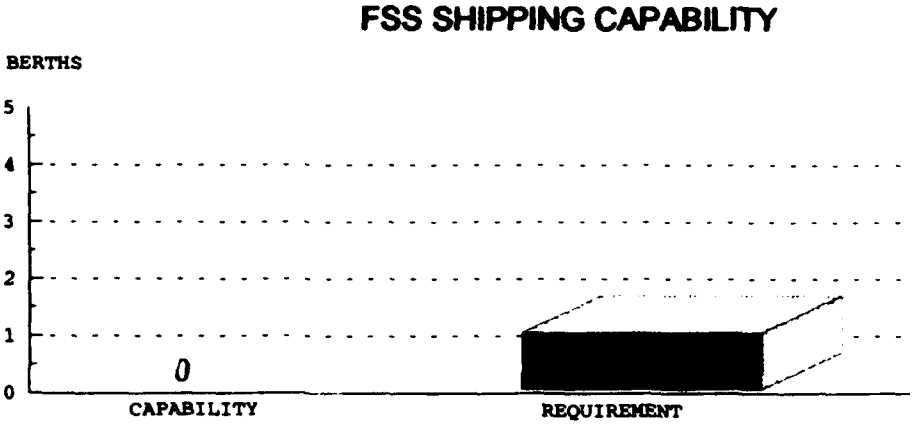
Legend:

RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, 91.

SHIPPING



The number of ships needed to load this requirement depends on the shipping mix selected. The best ship mix would require three FSS vessels and one Cape H RORO ship. However, the ship channel is too shallow to allow passage of a fully loaded FSS or Cape H RORO ship. Considering this, a brigade cannot outload in 6 days using FSS and RORO vessels. However, deploying units could outload using selected breakbulk and containership vessels. (See above table for number of breakbulk and containership vessels needed to deploy a brigade.)

SUMMARY

The ship channel and harbor shallow draft (30 feet MLW) limits the Port of Gulfport to selected breakbulk, containership, and RORO vessels unless the Army deploys partial FSS and Cape H shiploads.

Because of the lack of railcar storage space at the port, the flow of incoming equipment via the rail transport mode depends on the number of trains coming in per day from the local railyard. The current support is two trains per day.

The port's capability to meet rail inprocessing/handling capability requirements depends on the availability of a second railcar end ramp.

The shipping subsystem is the constraining factor in the throughput capability for the Port of Gulfport.

RECOMMENDATIONS

We do not recommend deploying a mechanized infantry brigade through the Port of Gulfport unless select ships are available for deployment. The shallow ship channel and harbor limit deployments to selected breakbulk, RORO, and containership vessels.

We recommend a reevaluation of the Port of Gulfport in the future after completion of the channel and harbor basin dredging project. This project is scheduled for completion on 1 December 1993.

PORT OF HOUSTON

HOUSTON, TEXAS

I. GENERAL DATA

TRANSPORTATION ACCESS

WATER

The Port of Houston consists of two terminals: Turning Basin and Barbours Cut. The Turning Basin Terminal is on the east side of Houston, with berths on both sides of the Houston Ship Channel (HSC).

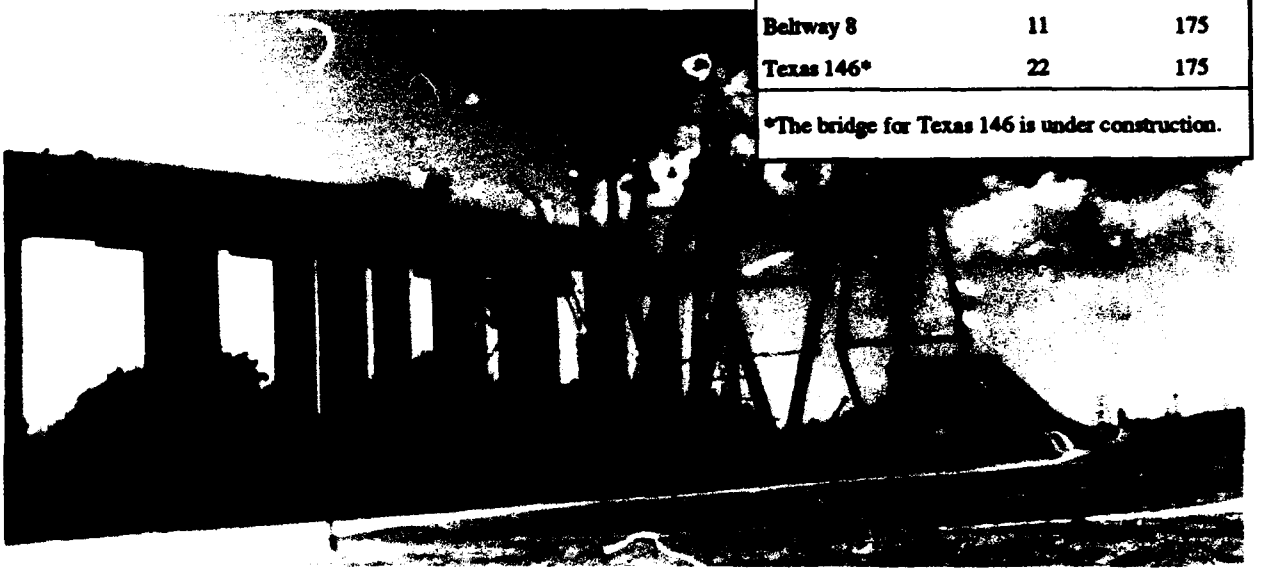
Barbours Cut Terminal is about 20 miles east, in Morgan's Point. All berths are in a row along an industrial canal off HSC.

Entrance to the port is via HSC. This channel varies from 36 to 42 feet deep at mean low water (MLW) and 300 to 800 feet wide. Ships pass the Barbours Cut Terminal enroute to the Turning Basin Terminal. Three overhead restrictions cross the channel between the two terminals. No other overhead restrictions exist below the Barbours Cut Terminal.

Water Access

I-610	2	135
Beltway 8	11	175
Texas 146*	22	175

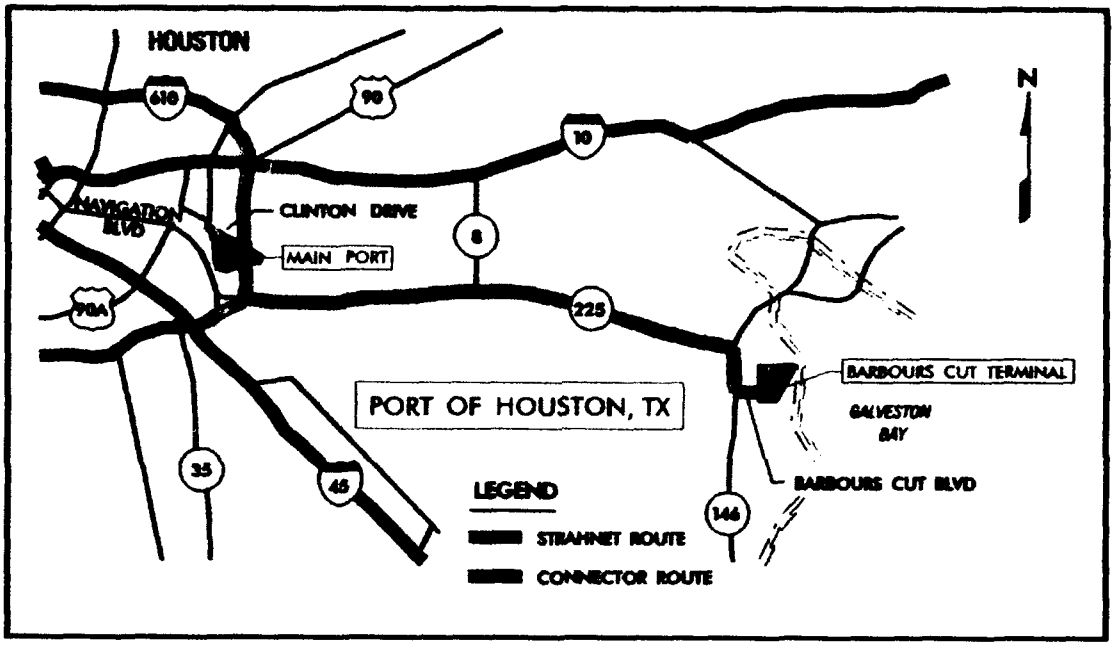
*The bridge for Texas 146 is under construction.



Texas Route 146 Bridge Construction

HIGHWAY

An extensive network of highways serves the Port of Houston. The port area has access to Interstate Routes 610, 10, and 45. Access to the north side of the Turning Basin Terminal is directly off I-610 (east loop), via exit 29 or Clinton Drive. These routes lead to Gates A, 8, 1, and AA. Access to the south side of the Turning Basin Terminal is via Navigation Boulevard to either 75th Street and Gate 15 or 76th Street and Gate 18. Gate 15 is normally closed and unmanned. Gate 18 is manned during the day. Traffic congestion is chronic around the terminal. Access to the Barbours Cut Terminal from Texas 225 or 146 is via Barbours Cut Boulevard (Route 410). The terminal has four gates directly off Barbours Cut Boulevard. No congestion prevails in this rural area.



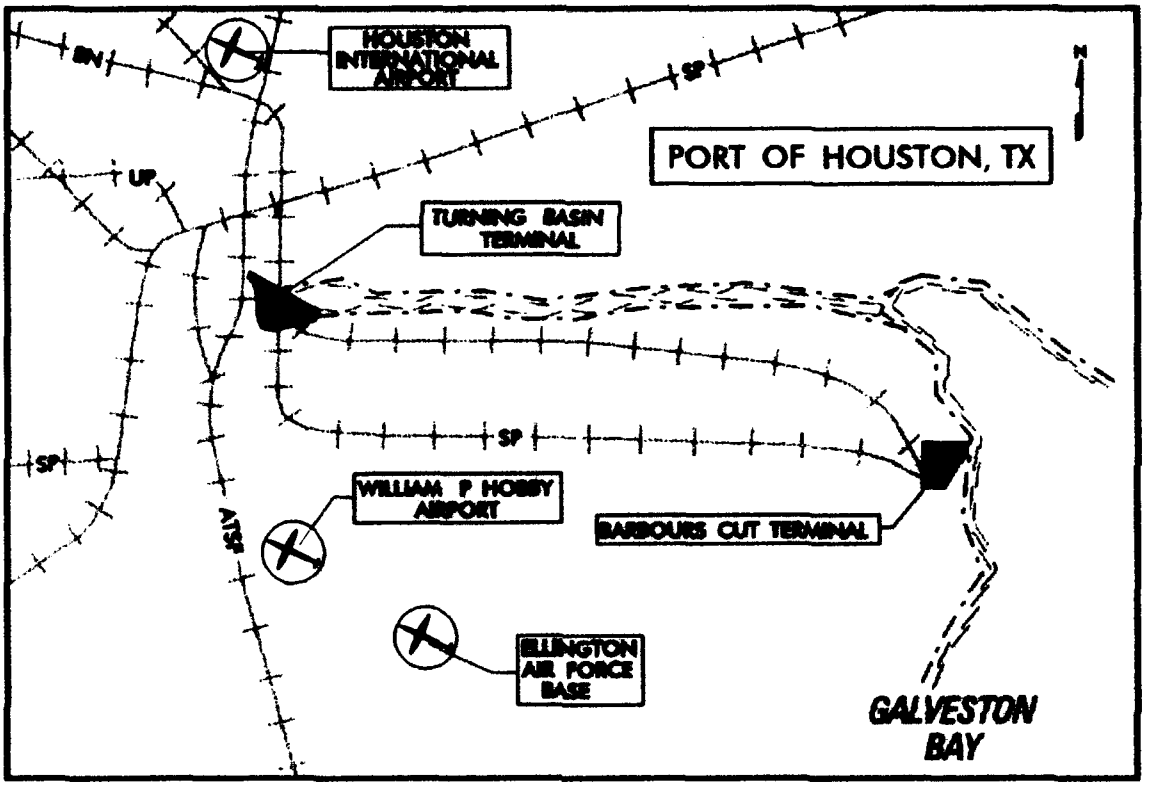
Highway Access

Barbours Cut Gate at Berth 3

RAIL

The four major railroad companies that serve the Port of Houston are the Atchison, Topeka, and Santa Fe (ATSF), Burlington Northern (BN), Southern Pacific (SP), and Union Pacific (UP). Within the port, the Port Terminal Railroad Association (PTRA) provides switching for freight cars entering and within the port.

Four regional railyards - PTRA, Houston Belt and Terminal (HB&T), UP, and SP - serve the Port of Houston. These railyards range in capacity from 2,000 to 4,400 cars. Rail clearances are sufficient for bilevel and trilevel railcars to access the port.



Rail and Air Access

AIRPORTS

The three largest airports that serve the Port of Houston are Houston Intercontinental Airport, William P. Hobby Airport, and Ellington Air Force Base. All of these are within 12 miles of the Turning Basin Terminal.

AIRPORTS NEAR THE PORT OF HOUSTON

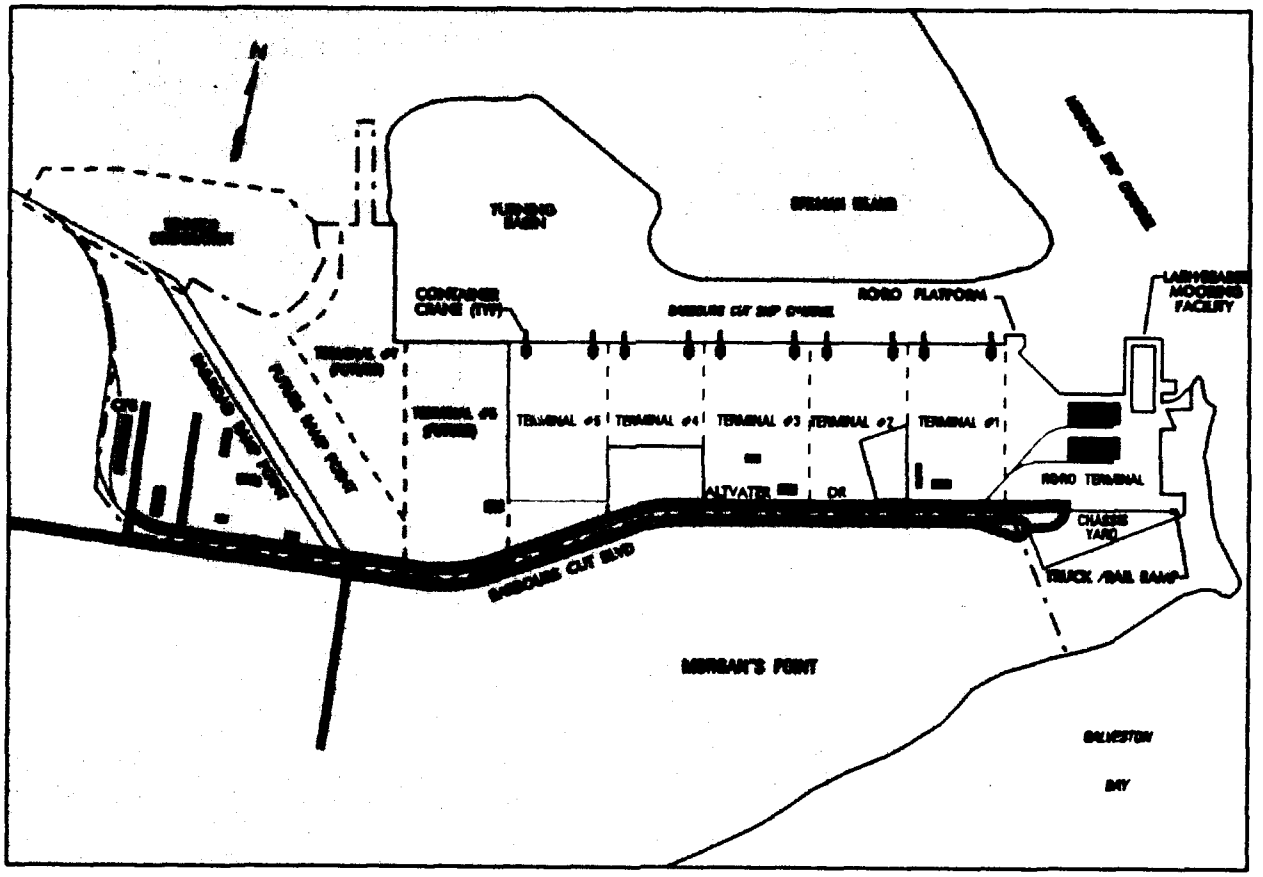
Main Runway:			
Length (ft)	12,000	7,600	9,000
Width (ft)	150	150	150

BERTH FACILITIES

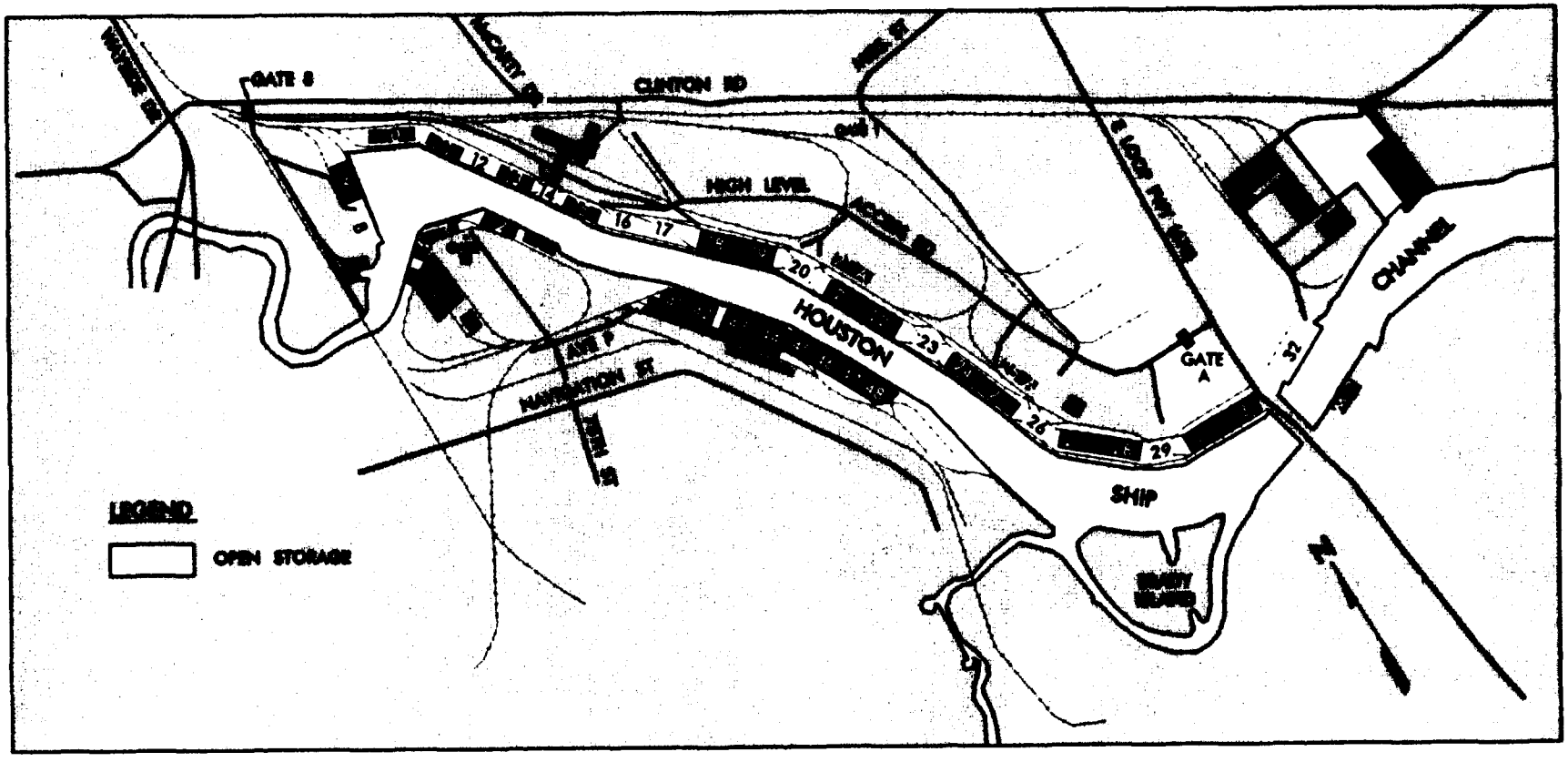
BERTHING

The Turning Basin Terminal handles predominantly breakbulk cargo, while the Barbours Cut Terminal handles predominantly containerized cargo. Both terminals consist of marginal wharves. Most of the wharves at the Turning Basin Terminal and all the wharves at the Barbours Cut Terminal consist of concrete piles with steel sheet bulkheads. Fendering at the Turning Basin Terminal is timber, except for berth 15, which has rubber fendering on a timber bulkhead. Fendering at the Barbours Cut Terminal is rubber-cushioned steel and timber. Both terminals have adequate lighting for night operations.

Below are land-use maps that show the berthing and port facilities of both terminals. Figures 1 and 2 are aerial views, which include tables identifying berth characteristics.



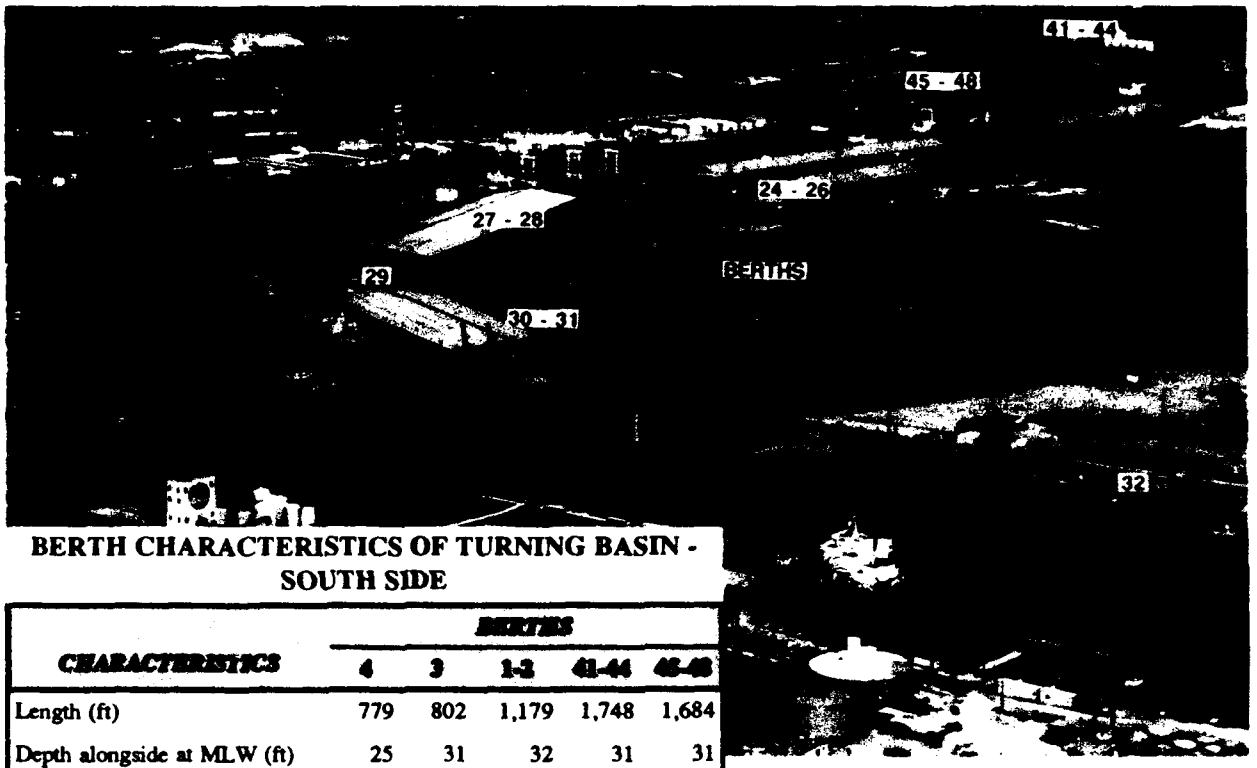
Barbours Cut Terminal Land-Use Map



Turning Basin Terminal Land-Use Map

BERTH CHARACTERISTICS OF TURNING BASIN - NORTH SIDE

CHARACTERISTICS	BERTHS											
	8-9	10	11-13	14-15	16-17	18-19	20-21	22-23	24-26	27-28	29	30-31
Length (ft)	1,205	600	1,520	960	1,154	1,177	1,193	1,200	1,800	1,200	600	1,176
Depth alongside at MLW (ft)	33	31	31	33	37	37	37	37	37	37	37	37
Deck strength (psf)	500	600	500	500	500	500	600	600	750	750	750	750
Apron width (ft)	Open	46	30	30	Open	52	52	52	56	60	Open	60
Apron height above MLW (ft)	19	16	16	16	16	16	16	16	16	16	16	16
Number of container cranes	0	0	0	0	0	0	0	0	0	0	0	1
Number of wharf cranes	0	0	0	0	0	0	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	Yes	No	No	No	No	No	No	No	No	No	No	No
Apron length served by rail (ft)	1,205	600	1,520	960	1,154	1,177	1,193	1,200	1,800	1,200	600	1,176



BERTH CHARACTERISTICS OF TURNING BASIN - SOUTH SIDE

CHARACTERISTICS	BERTHS				
	4	3	1-2	41-44	45-48
Length (ft)	779	802	1,179	1,748	1,684
Depth alongside at MLW (ft)	25	31	32	31	31
Deck strength (ft)	500	500	500	500	500
Apron width (ft)	25	30	30	40	25
Apron height above MLW (ft)	9	9	13	16	16
Number of container cranes	0	0	0	0	0
Number of wharf cranes	0	0	0	1	0
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No
Apron length served by rail (ft)	0	802	0	1,748	1,684

Figure 2. Turning Basin Terminal (northwest view).

BERTH CHARACTERISTICS OF BARBOURS CUT TERMINAL

Length (ft)	1,000	1,000	1,000	1,000	1,000
Depth alongside at MLW (ft)	42	42	42	42	42
Deck strength (ft)	1,000	1,000	1,000	1,000	1,000
Apron width (ft)	Open	Open	Open	Open	Open
Apron height above MLW (ft)	12	12	12	12	12
Number of container cranes	2	2	2	2	2
Number of wharf cranes	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stem RORO facilities	Yes	No	No	No	No
Apron length served by rail (ft)	0	0	0	0	0

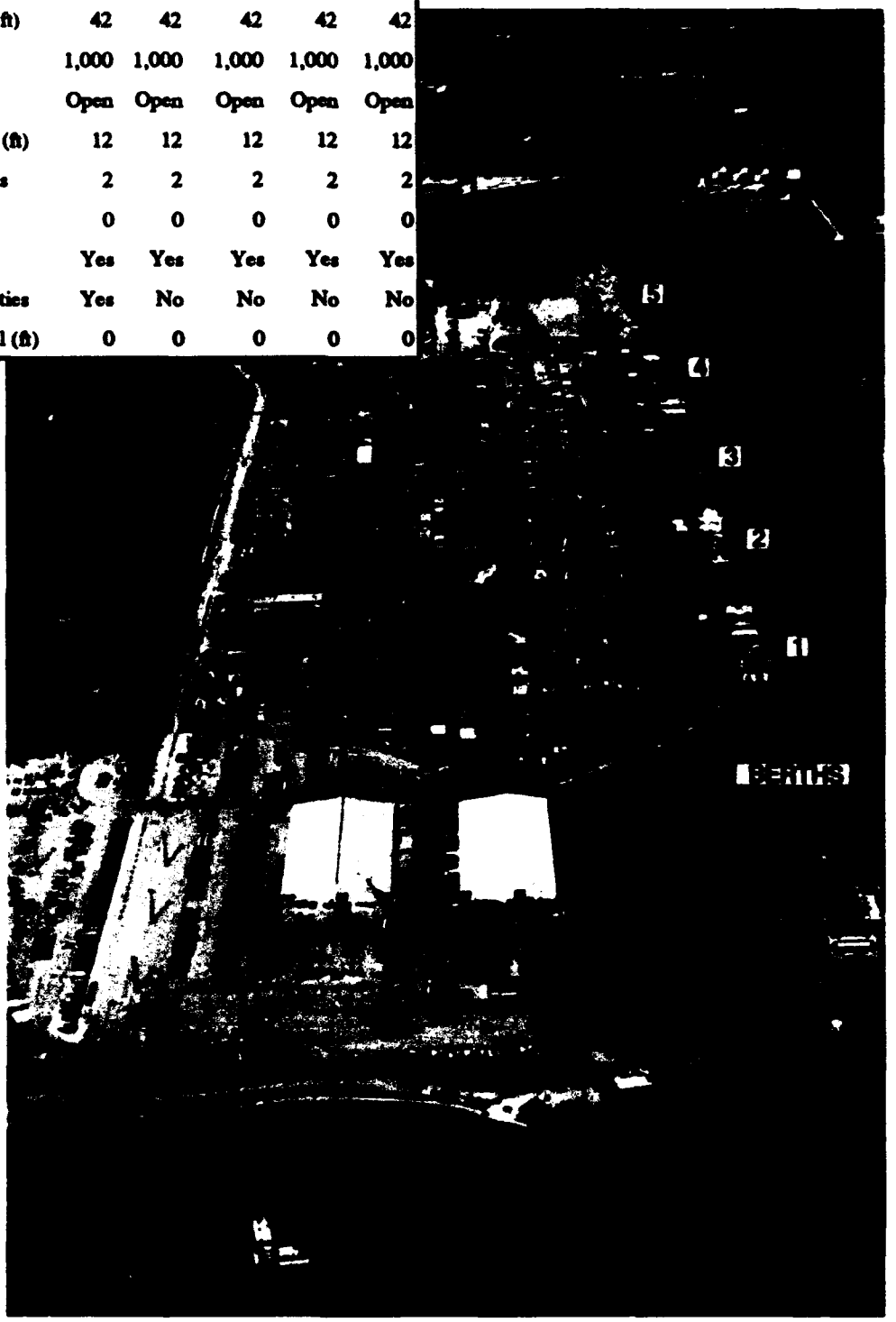


Figure 3. Barbours Cut Terminal (westward view).

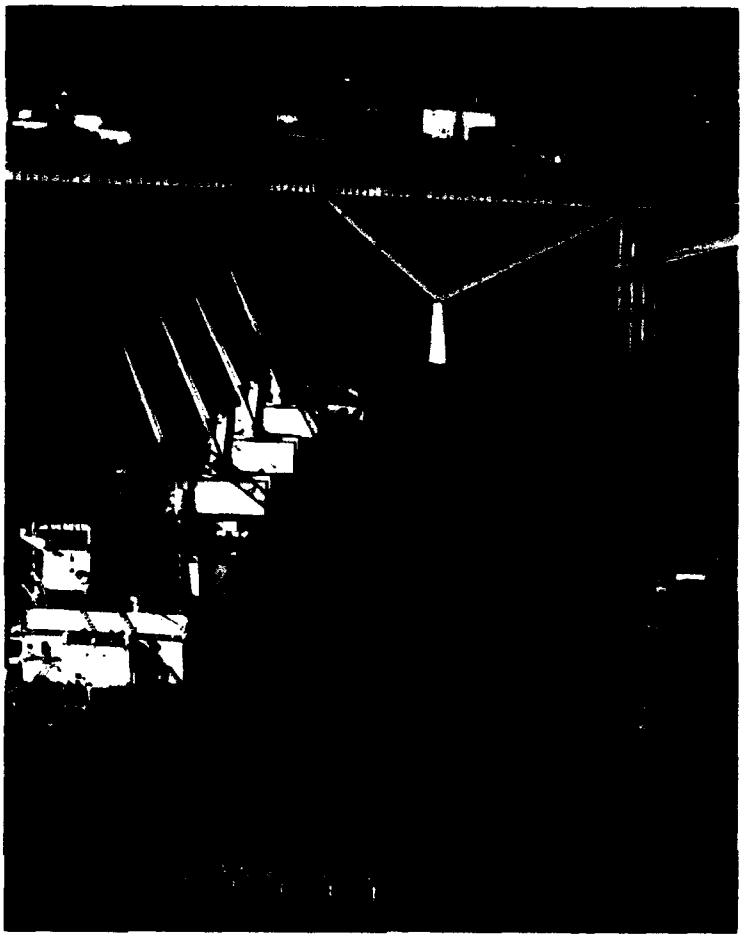
STAGING

Open Staging

The two terminals at the Port of Houston have about 200 acres of open staging available. Of this, 180 acres are paved. The remaining area is slag covered or unimproved. Of the 180 paved acres, 130 are at the Barbours Cut Terminal. Most of the paved open areas at the Turning Basin Terminal are near berths 30-32.

The best location for helicopter operations at the Turning Basin Terminal is the cargo staging area of berth 32. Good locations for helicopter operations at the Barbours Cut Terminal is the inland end of berth 5.

Temporary shelters and portable lighting are required to support reduction and shrink-wrapping operations at either terminal.



Open Staging Area at Turning Basin Berth 32

Covered Staging

Thirty-three sheds and warehouses provide about 3,000,000 square feet of covered storage.

RAIL

Rail trackage links the railyards to aprons on the port and to boxcar-handling tracks at the Turning Basin Terminal and the Barbours Cut Terminal. All the Turning Basin Terminal aprons have one or more tracks, except berths 1, 2, 4, and 32. None of the Barbours Cut Terminal aprons have tracks.

Railyards on the port can store about 2,500 89-foot railcars. Railyards within 8 miles of the Turning Basin Terminal can store about 12,000 89-foot railcars.

HIGHWAY

The port roads are generally two laned and concrete. The High Level Access Road provides express transit between berths along the north side of the Turning Basin Terminal. The port has no clearance restrictions.

Barbours Cut Terminal has nine 60-ton scales. The Turning Basin Terminal has no truck scales.

UNLOADING/LOADING POSITIONS

Ramps

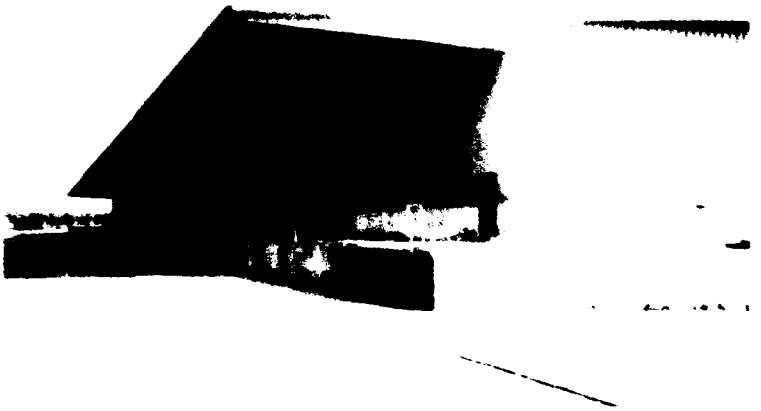
The Turning Basin Terminal has no permanent rail or truck end ramps. However, the port maintains one permanent rail end ramp at the east end of the Barbours Cut Terminal. Also, next to the track is space for a flatbed trailer to offload. Just west of the terminal, off L Street, are two temporary gravel and timber rail end ramps.

Truck-Train End Ramp at Barbours Cut Terminal

Two-Track Railhead at Barbours Cut Terminal Near L Street

Docks

All the transit sheds have docks that are suitable for boxcar or van handling. A few sheds also have docks on their sides for trucks only. All together, the port has about 240 truck docks and 280 boxcar handling positions.



Rail-Truck Docks at Barbours Cut CFS

MARSHALING AREAS

Within Port

The port has no marshaling areas. All open area within the port is required for staging.

Offsite

The Houston area is highly developed. It has no areas larger than 5 acres within 5 miles of the Turning Basin Terminal. All the open area at the Barbours Cut Terminal is required for staging commercial or military cargo.

MATERIALS HANDLING EQUIPMENT

The Port of Houston Authority owns several cranes, MHE, and CHE. The container crane at the Turning Basin Terminal can access berths 23-31. Local stevedore companies can provide mobile cranes with capacities ranging from 50 to 300 tons.

PORT-OWNED MHE AND CHE

Container Cranes	40	1	TB
	50	2	BC
	40	6	BC
	30	2	BC
Mobile Crane	82	1	BC
Transtainers	30	8	BC
	40	3	BC
Container Handlers	15	3	BC

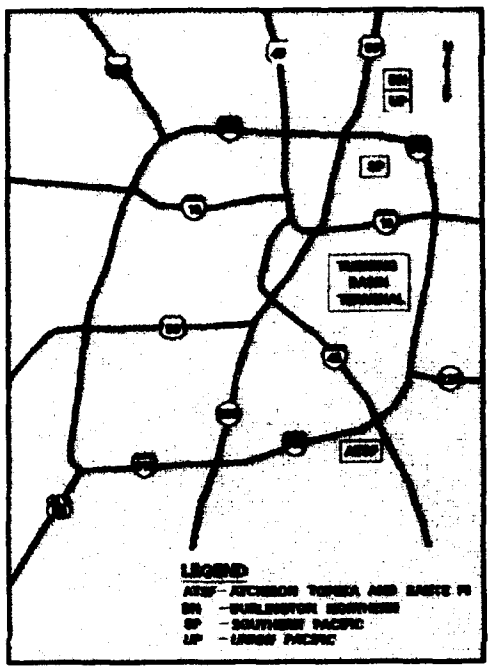
Container Handler

Barbours Cut Container Cranes

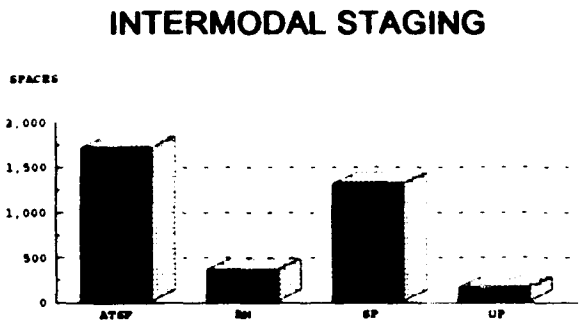
INTERMODAL FACILITIES

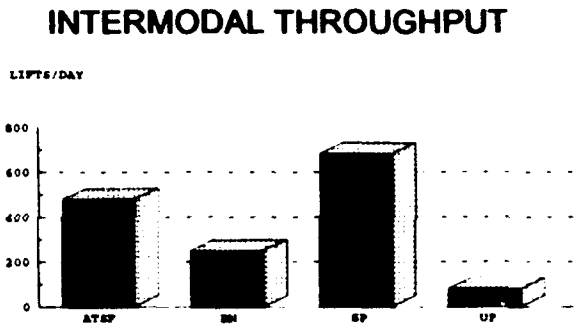
GENERAL

Four railroad companies operate intermodal railyards in the Houston area.



Intermodal Facilities





FUTURE DEVELOPMENT

The Port of Houston Authority expects to demolish the Turning Basin Terminal sheds 45 to 48 to build a berth for scrap metal operations. The Barbours Cut Terminal will continue to expand westward until berth 7 is complete. Plans call for berth 6 to be operational by early 1995.

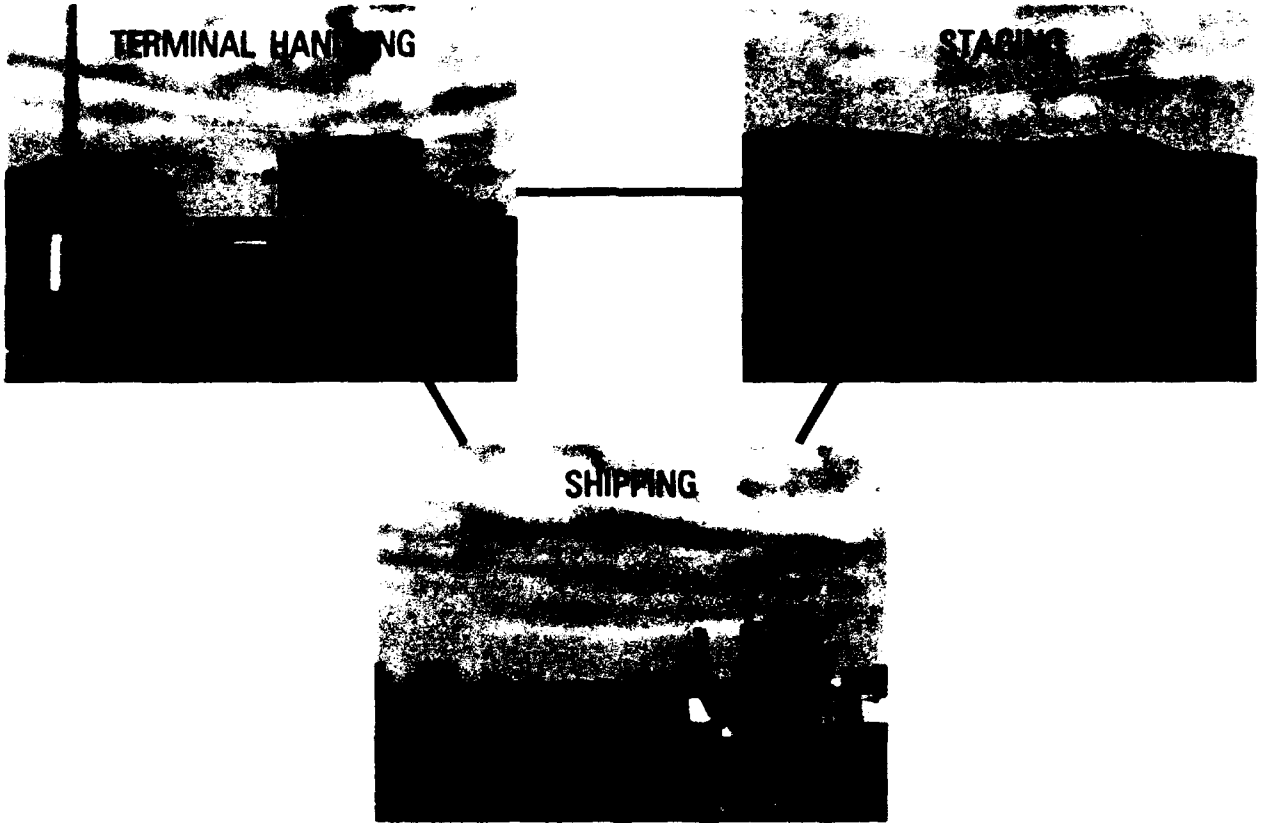
Barbours Cut Berth Expansion

Highway access will improve as new beltways around the city develop. Beltway 8 is about one-third complete. Construction has begun for the Grand Parkway Loop, which will provide direct access to the Barbours Cut Terminal. Part of the Grand Parkway Loop, the I-146 bridge, is under construction. To provide access to Barbours Cut for tall loads, this bridge will have an overhead clearance of 22 feet.

II. THROUGHPUT ANALYSIS

GENERAL

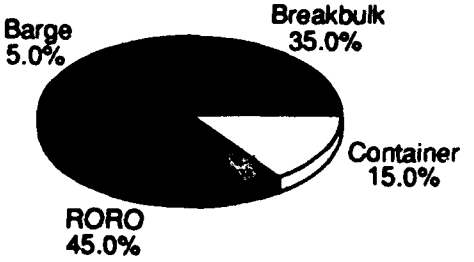
We evaluated the throughput capability of the Port of Houston using the port operational performance simulator (POPS) computer model. The POPS model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/handling - in short tons (STON) per day.



Terminal Throughput Subsystems

The analysis assumes that 80 percent of the port facilities will support military deployments. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.

SHIP MIX PERCENTAGES



RECEPTION/HANDLING

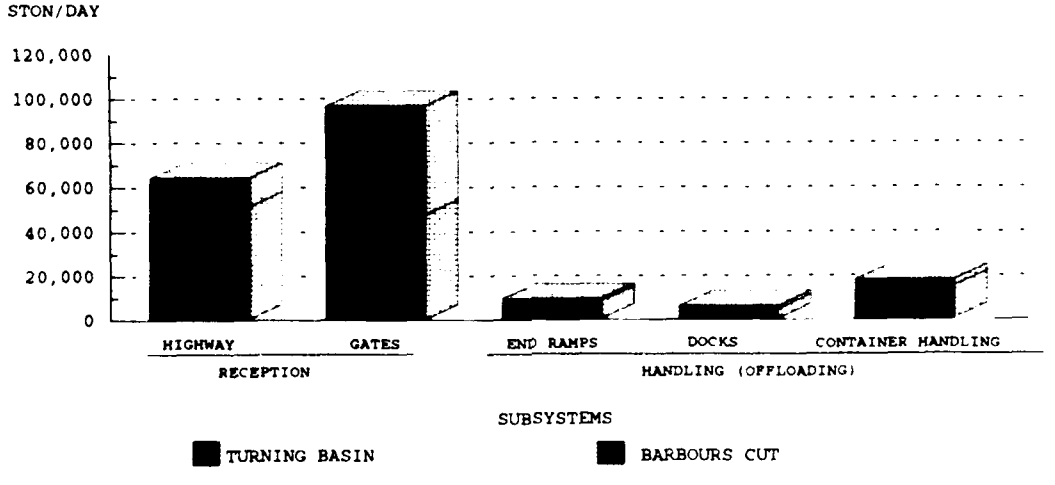
HIGHWAY

Interstate Routes 610, 10, and 45 provide access to the Turning Basin Terminal. Clinton Drive, Navigational Boulevard, and 75th and 76th Streets provide direct access to the six Turning Basin Terminal gates. Texas 225 or 146 provides access to the Barbours Cut Terminal via Barbours Cut Boulevard (Route 410). Four gates allow entrance into the Barbours Cut Terminal. The road network in and out of the port, including the gate processing of vehicles, could handle more than 60,000 STON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to staging areas. Vehicles on commercial or military flatbed trailers without integral ramps will offload at portable ramps. However, the Turning Basin Terminal has no permanent truck end ramps. Our analysis assumes four portable ramps inland of berths 18 and 19 and one inland of berth 1-2 at the Turning Basin Terminal. Vehicles on flatbed trailers can offload at the Barbours Cut Terminal at the ramp built alongside the rail end ramp at the far east end of the terminal. These six ramps could offload more than 9,600 STON from flatbed trailers per day.

Supplies in van semitrailers will proceed to the 144 handling positions. These truck docks can offload about 5,900 STON of van semitrailer-shipped material per day. Containers on chassis will move to the staging areas to be offloaded. One container handler at the container marshaling yard of the Turning Basin Terminal and two container handlers at the open staging areas at the Barbours Cut Terminal could each offload 1,500 STON in containers from their chassis per day.

HIGHWAY RECEPTION HANDLING CAPABILITY



RAIL

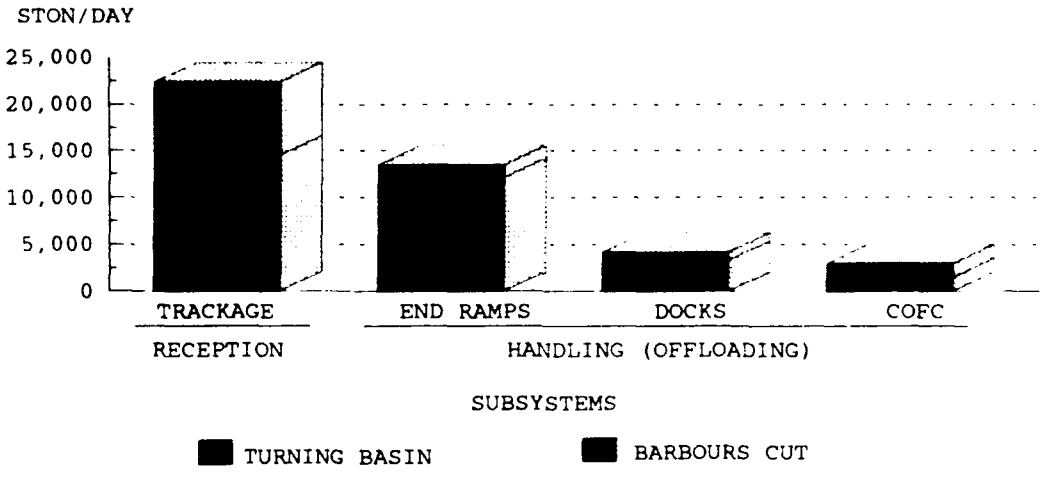
Rail reception at the Turning Basin Terminal is very good, with four major railroad companies serving the Houston area. Railyards within the port could store more than 3,500 railcars. Also, commercial railyards within 12 miles of the Turning Basin Terminal could store more than 18,000 additional railcars. The service is limited to the Barbours Cut Terminal because of commercial traffic and a lack of storage yards in the Morgans Point area. It is possible that six 100-railcar trains per day can access the port's terminals.

Vehicles on flatcars could be offloaded at the permanent end ramp at the east end of the Barbours Cut Terminal, or the two temporary end ramps near L Street west of the Barbours Cut Terminal. Boxcars could be offloaded at the transit sheds, where about 275 boxcar handling positions are available. Containers could be offloaded at the container marshaling yard of the Turning Basin Terminal, or on the tracks adjacent to the sheds at Barbours Cut Terminal. A container handler at each terminal could each offload 1,500 STON per day.

POTENTIAL PORTABLE END RAMP LOCATIONS AND LENGTHS

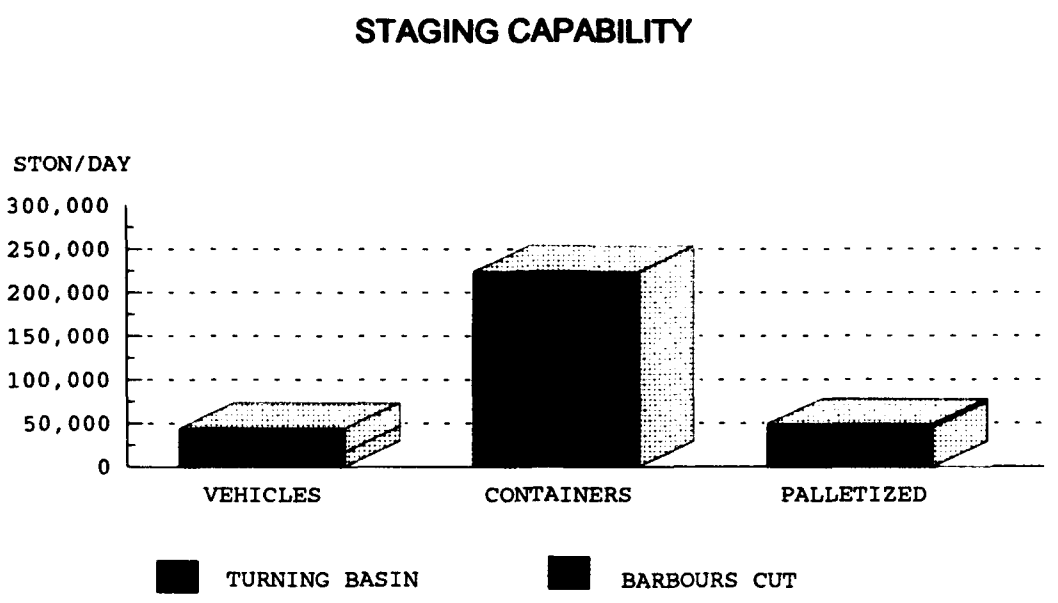
Turning Basin (North Side)	
Inland of shed 18-19	10
Inland of shed 21-22	10
Container marshaling yard	8
Turning Basin (South Side)	
HB&T Booth Railyard	20
Barbours Cut	
Storage tracks west of berth 7 (2 tracks)	32 each
CFS	12
RORO sheds (2 tracks)	7 each

RAIL RECEPTION/HANDLING CAPABILITY



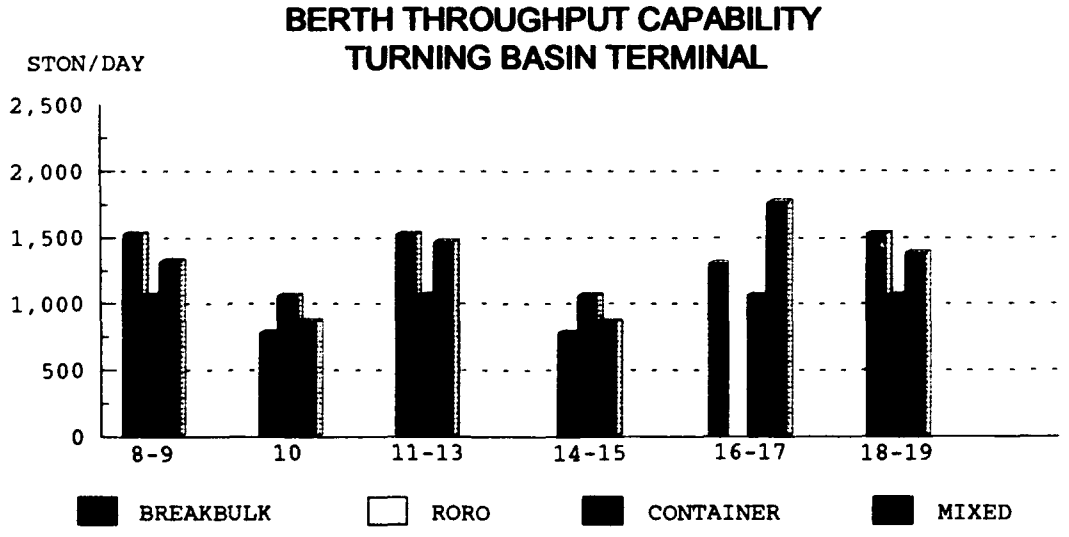
STAGING

The port has about 200 acres of open storage for vehicles and/or containers. It also has about 3,000,000 square feet of covered storage.

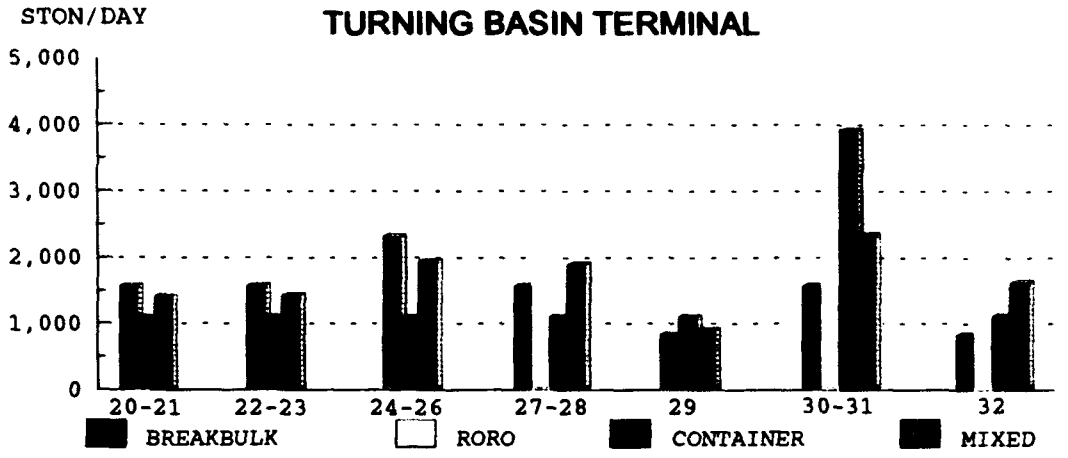


SHIPPING

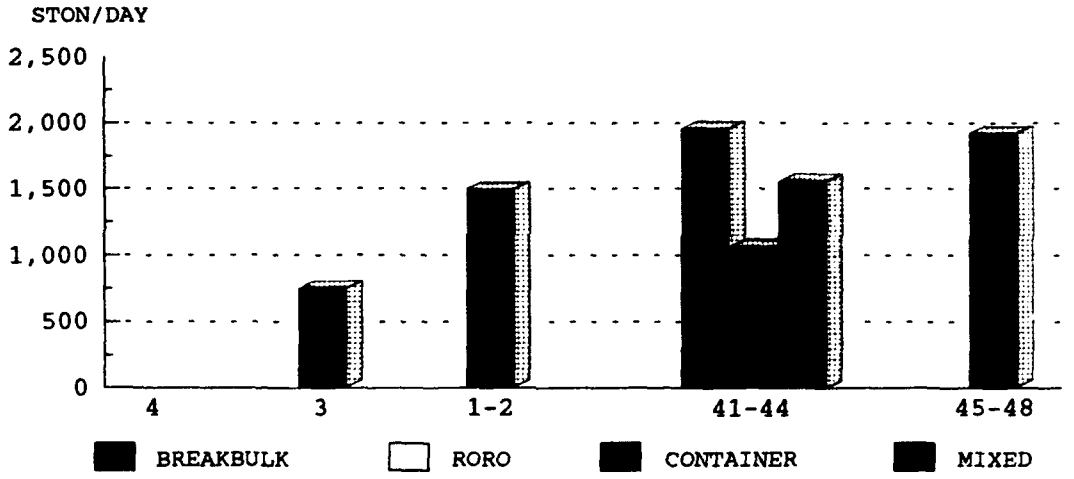
The bar graphs below show the throughput capability per berth in STON per day for breakbulk, RORO, container, and mixed vessels. These results were based on various factors, including MHE used, loading, operational, and berth usage rates as well as berth/ship compatibility.



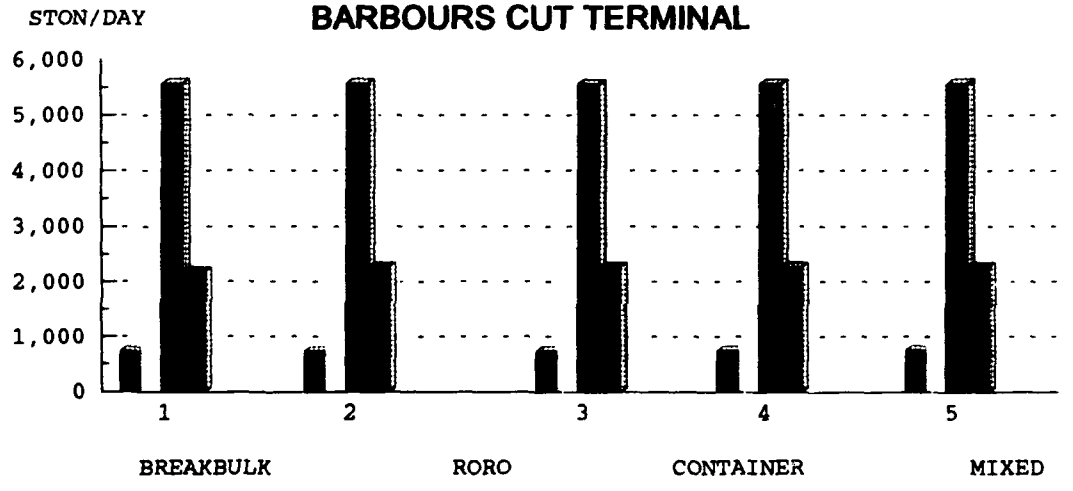
BERTH THROUGHPUT CAPABILITY
TURNING BASIN TERMINAL



BERTH THROUGHPUT CAPABILITY
TURNING BASIN TERMINAL



BERTH THROUGHPUT CAPABILITY
BARBOURS CUT TERMINAL



The berth/ship compatibility for various vessel types is shown in tables 1 through 3. The tables also provides the limitations that can hinder shipping operations.

The type of ship preferred at each berth is based on the methodology described in the appendix. The evaluation is based on a snapshot view of the current physical characteristics of the berths and the MHE available. The evaluation gives no considerations for enhancements, such as equipment.

The berths at the Barbours Cut Terminal provide the largest throughput capacity for container and RORO vessels. Berth 1 is the best berth because of its RORO ramp and nearby transit sheds.

PREFERENCE BERTH SELECTION

Turning Basin			
8-9	7	-	-
10	9	-	-
11-13	9	-	-
14-15	7	-	-
16-17	21	6	-
18-19	6	-	-
20-21	5	-	-
22-23	1	-	-
24-26	1	-	-
27-28	1	7	6
29	20	-	-
30-31	14	-	6
32	22	7	-
4	23	-	-
3	9	-	-
1-2	19	-	-
41-44	9	-	-
45-48	9	-	-
Barbours Cut			
1	1	1	1
2	14	1	1
3	14	2	1
4	14	2	1
5	14	2	1

TABLE 1

SUMMARY OF HOUSTON BERTHING CAPABILITIES - NORTH

Breakbulk													
C3-S-33a	2	1	2	1	2	2	2	2	3	2	1	2	1
C3-S-37c	2	a	a	1	2	2	2	2	3	2	1	2	1
C3-S-37d	2	1	2	1	2	2	2	2	3	2	1	2	1
C3-S-37a	2	1	2	1	2	2	2	2	3	2	1	2	1
C4-S-1a	2	1	2	1	1	1	2	2	3	2	1	1	1
C4-S-1qb and 1u	2	a	a	1	1	1	2	2	3	2	1	1	1
C4-S-58a	2	1	2	1	1	1	1	2	3	2	1	1	1
C4-S-65a	2	1	2	1	1	2	2	2	3	2	1	2	1
C4-S-66a	2	a	a	1	2	2	2	2	3	2	1	2	1
C4-S-69b	1	a	a	1	1	1	1	1	2	1	1	1	1
Seatrain													
GA and PR-class	2	1	2	1	1	2	2	2	3	2	1	2	1
Barge													
LASH C8-S-81b	a,f	a,c,f	a,f	a,f	1	1	1	1	2	1	c	1	c
LASH C9-S-81d	a	a,c	a	a	a	a	a	a	a	a	a,c	a	a,c
LASH lighter	8	4	10	6	8	8	8	8	12	8	4	8	5
SEABEE C8-S-82a	a	a,c	a	a	a	a	a	a	a	a	a,c	a	a,c
SEABEE barge	6	3	7	4	5	5	5	6	9	6	3	5	4
RORO													
Comet	i,j	d,o	d,o	d,o	d,i,j	d,o	d,o	d,o	d,o	d,o	d,i,j	d,o	d,i,j
C7-S-95a/Maine-class	a	a,b,c	a,b	a,b	1,i	b	b	b	b	1,i	c	1,i	1,i
Ponce-class	h	b,c,h	b,h	b,h	h	b,h	b,h	b,h	b,h	b,h	c,h	b,h	h
Great Land-class	h	b,c,h	b,h	b,h	h	b,h	b,h	b,h	b,h	b,h	c,h	b,h	h
Cygnus/Pilot-class	i,j	b,c	b	b	1,i	b	b	b	b	1,i	c	1,i	1,i
Meteor	i,j	d,o	d,o	d,o	d,i,j	d,o	d,o	d,o	d,o	d,o	d,i,j	d,o	d,i,j
AmEagle/Condor	i,j	b,c	b	b	i,j	b	b	b	b	i,j	c	i,j	i,j
MV Ambassador	i,j	d	d	d	d	d	d	d	d	d	d	d	d
FSS-class	a	a,b,c	a,b	a,b	i,j	b	b	b	b	i,j,n	c	i,j,n	c
Cape D-class	i,j	a,b,c	a,b	b	i,j	b	b	b	b	i,j	c	i,j	i,j
Cape H-class	a	a,b,c	a,b	a,b	i,j	b	b	b	b	i,j	c	i,j	i,j
Container													
C6-S-1w	1,e	c,e	2,e	1,e	1,e	1,e	1,e	1,e	2,e	1,e	c,e	1	1,e
C7-S-68e	1,e	a,c,e	a,e	1,e	1,e	1,e	1,e	1,e	2,e	1,e	c,e	1	1,e
C8-S-85c	1,e	a,c,e	a,e	1,e	1,e	1,e	1,e	1,e	2,e	1,e	c,e	1	c,e
Combination													
C5-S-78a	a,e	a,c,e	a,e	a,e	1,e	1,e	1,e	1,e	2,e	1,e	c,e	1	1,e
C5-S-37e	1,e	1,e	2,e	1,e	1,e	1,e	1,e	1,e	2,e	1,e	1,e	1	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no-shored based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

TABLE 2
SUMMARY OF HOUSTON BERTHING CAPABILITIES - SOUTH

Breakbulk					
C3-S-33a	a	1	2	3	3
C3-S-37c	a	a	2	a	a
C3-S-37d	a	1	2	3	3
C3-S-37a	a	1	2	3	3
C4-S-1a	a	1	2	2	2
C4-S-1qb and 1u	a	a	1	a	a
C4-S-58a	a	1	1	2	2
C4-S-65a	a	1	2	2	2
C4-S-66a	a	a	a	a	a
C4-S-69b	a	a	1	a	a
Seatrain					
GA and PR-class	a	1	2	2	2
Barge					
LASH C8-S-81b	a,c,f	a,c,f	a,f	a,f	a,f
LASH C9-S-81d	a,c	a,c	a	a	a
LASH lighter	5	5	8	12	12
SEABEE C8-S-82a	a,c	a,c	a	a	a
SEABEE barge	3	4	5	8	8
RORO					
Comet	a,d,o	d,o	d,o	d,o	d,o
C7-S-95a/Maine-class	a,b	a,b	a,b	a,b	a,b
Ponce-class	a,b,h	b,h	b,h	b,h	b,h
Great Land-class	a,b,c,h	b,h	b,h	b,h	b,h
Cygnus/Pilot-class	a,b	b	b	b	b
Meteor	a,d,o	d,o	d,o	d,o	d,o
AmEagle/Condor	a,b	b	b	b	b
MV Ambassador	d	d	d	d	d
FSS-class	a,b,c	a,b,c	a,b	a,b	a,b
Cape D-class	a,b	a,b	a,b	a,b	a,b
Cape H-class	a,b	a,b	a,b	a,b	a,b
Container					
C6-S-1w	a,e	1,e	1,e	2,e	2,e
C7-S-68e	a,e	a,e	1,e	a,e	a,e
C8-S-85c	a,c,e	a,c,e	a,e	a,e	a,e
Combination					
C5-S-78a	a,e	a,e	a,e	a,e	a,e
C5-S-37e	a,e	1,e	1,e	2,e	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

TABLE 3
SUMMARY OF HOUSTON BERTHING CAPABILITIES BARBOURS CUT TERMINAL

Breakbulk					
C3-S-33a	1	1	1	1	1
C3-S-37c	1	1	1	1	1
C3-S-37d	1	1	1	1	1
C3-S-37a	1	1	1	1	1
C4-S-1a	1	1	1	1	1
C4-S-1qb and 1u	1	1	1	1	1
C4-S-58a	1	1	1	1	1
C4-S-65a	1	1	1	1	1
C4-S-66a	1	1	1	1	1
C4-S-69b	1	1	1	1	1
Seatrain					
GA and PR-class	1	1	1	1	1
Barge					
LASH C8-S-81b	1	1	1	1	1
LASH C9-S-81d	1	1	1	1	1
LASH lighter	7	7	7	7	7
SEABEE C8-S-82a	1	1	1	1	1
SEABEE barge	5	5	5	5	5
RORO					
Comet	i,j	d,i,j	d,i,j	d,i,j	d,i,j
C7-S-95a/Maine-class	1	1	1	1	1
Ponce-class	h	h	h	h	h
Great Land-class	h	h	h	h	h
Cygnus/Pilot-class	1	1	1	1	1
Meteor	i,j	d,i,j	d,i,j	d,i,j	d,i,j
AmEagle/Condor	i,j	i,j	i,j	i,j	i,j
MV Ambassador	1	d	d	d	d
FSS-class	1	1	1	1	1
Cape D-class	i,j	i,j	i,j	i,j	i,j
Cape H-class	1	1	1	1	1
Container					
C6-S-1w	1	1	1	1	1
C7-S-68e	1	1	1	1	1
C8-S-85c	1	1	1	1	1
Combination					
C5-S-78a	1	1	1	1	1
C5-S-37e	1	1	1	1	1

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
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k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

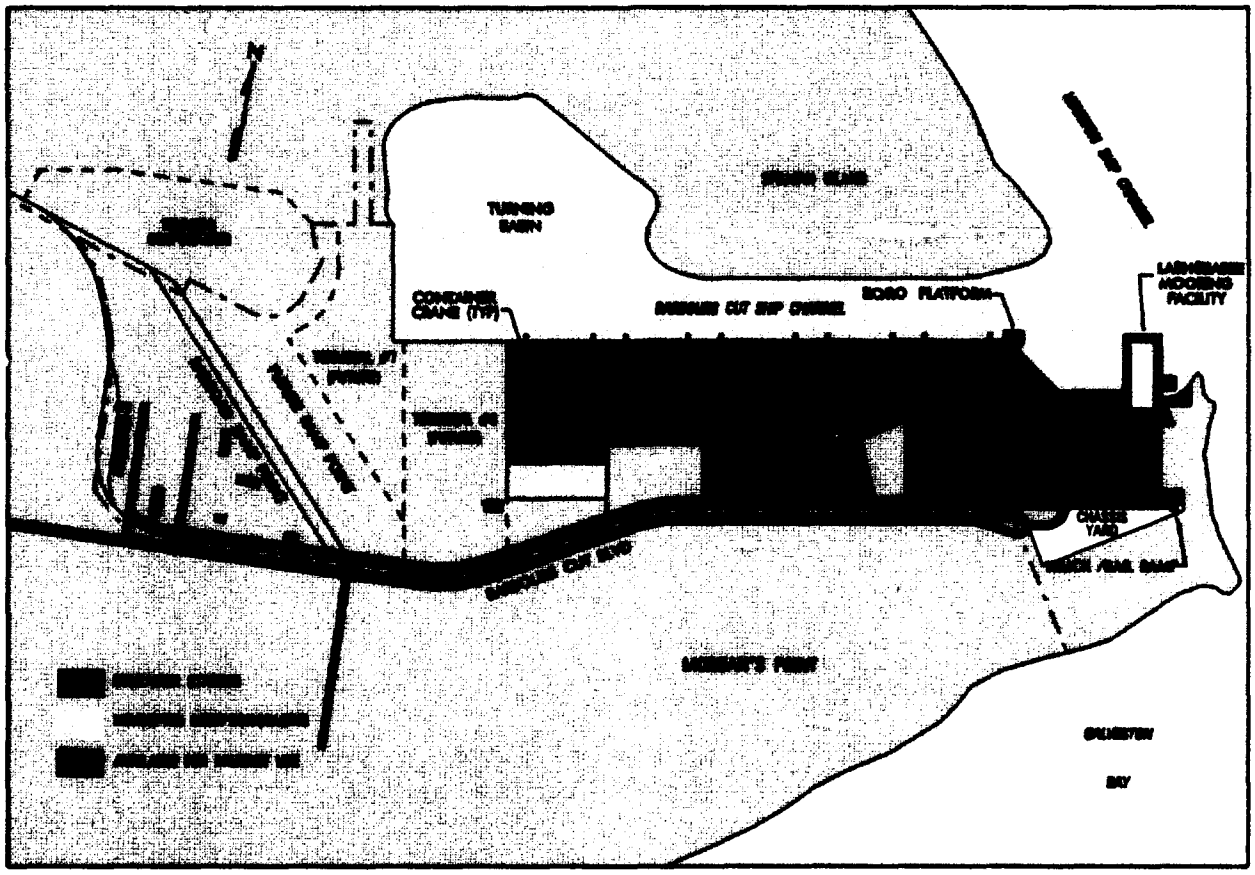
III. APPLICATION

GENERAL

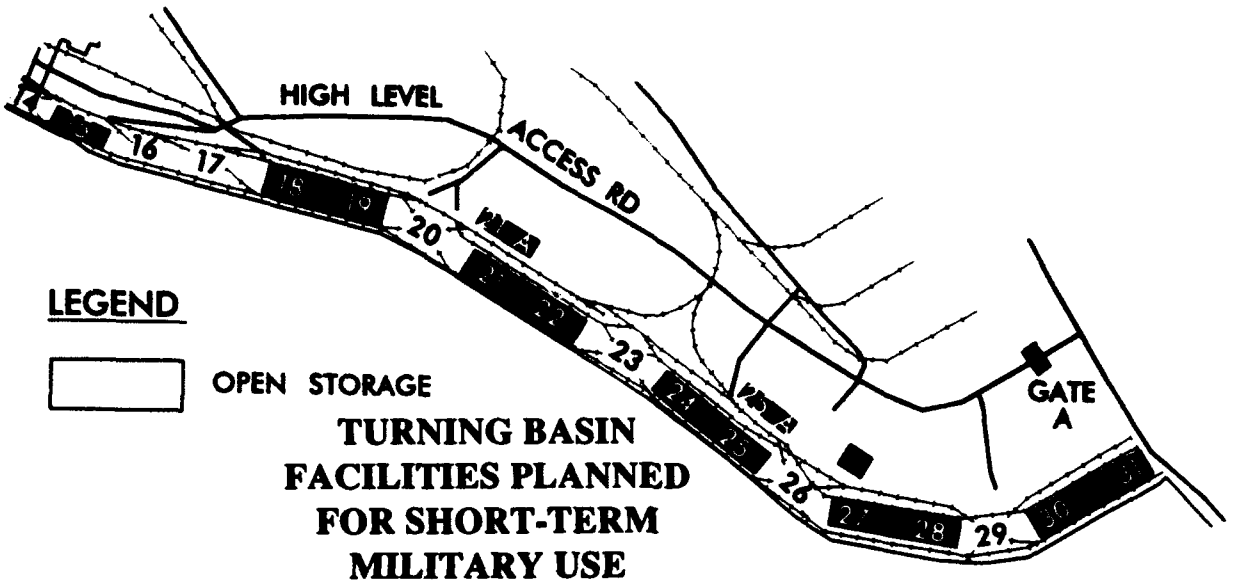
In this section, we evaluate the port's throughput capability for deploying a notional armored division using mainly FSS vessels. The analysis will use those facilities designated in the *Planning Orders Digest*, issued by MARAD. These orders call for the port to provide facilities prior to and during national defense mobilization. The port agrees to provide facilities for short-term usage and different facilities for long-term usage.

BARBOURS CUT FACILITIES PLANNED FOR SHORT-TERM MILITARY USE

1	23 Acres
2	22 Acres
RORO Platform	
LASH Facility	
RORO Staging	19.1 Acres and sheds



Designated MARAD Facilities (Barbours Cut)



TURNING BASIN FACILITIES PLANNED FOR SHORT-TERM MILITARY USE

16-17	4.6 Acres
18-19	
20-21	2.3 Acres
22-23	2.3 Acres
24-25	

Designated MARAD Facilities (Turning Basin)

FSS operations at the Turning Basin facilities provided by the Planning Orders are very limited for the following reasons:

The total open area (about 10 acres scattered) is insufficient to support sustained FSS operations.

The I-610 bridge height (135 feet above MHW) restricts a light FSS from passing.

The turning basin at the terminal is too small to safely turn an FSS.

The apron height (16 feet above MLW) limits FSS RORO operations.

Except for berth 32, the Turning Basin Terminal should only support military operations involving breakbulk ships. Since berth 32 is not in the Planning Orders for short-term or long-term military usage, this analysis will only consider the Planning Orders facilities at Barbours Cut. Long-term usage of these facilities for sustained FSS loading operations is assumed, despite the fact the planning orders only account for short-term usage.

REQUIREMENTS

The likely requirement for the Port of Houston is to deploy a notional armored division in 6 days of ship loading. The division has to move about 7,800 vehicles and 651 containers. The movement of this equipment to the port will require 1,060 (180 per day) railcars using the convoy/rail option. Under this option, about 3,700 (620 per day) roadable vehicles would be driven and about 2,300 (380 per day) would be towed.

ARMORED DIVISION DEPLOYMENT DATA

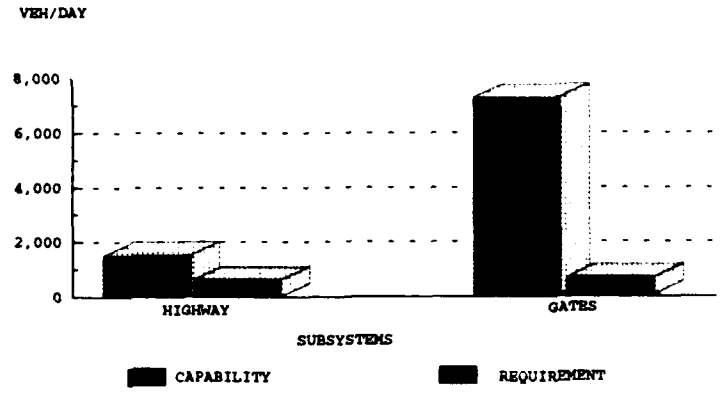
Total Equipment	
Volume	275,000 MTON
Weight	97,000 STON
Area	1,428,000 SQ FT
Vehicles	7,800
Containers	651

TERMINAL HANDLING

HIGHWAY

Vehicles and containers on chassis would access the Barbours Cut Terminal through the gate at berth 1, off Barbours Cut Boulevard. Both the access road and the gate could handle more than 1,500 vehicles per day.

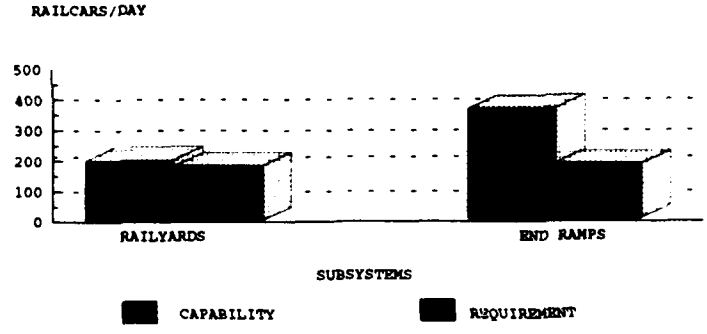
HIGHWAY INPROCESSING CAPABILITY



RAIL

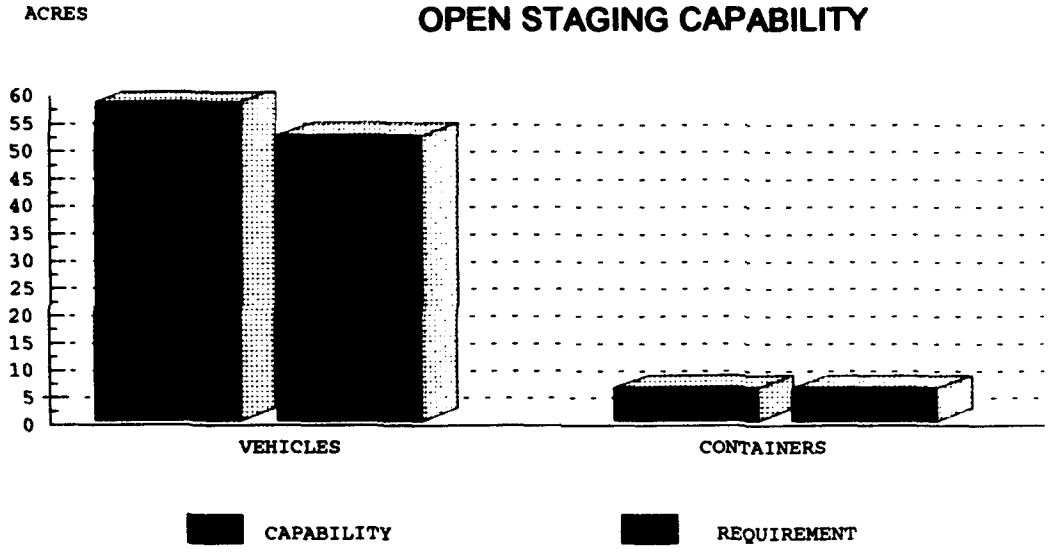
The classification yards near the Barbours Cut Terminal could receive about 200 railcars per day. Also, the 1 fixed and 3 portable rail end ramps could offload 90 flatcars every 5 hours, or 360 per day.

RAIL INPROCESSING/HANDLING CAPABILITY



STAGING

This analysis assumes that current downsizing continues and that nine FSS-sized ships will deploy an entire notional armored division. Three ships will depart every 2 days. Because of this, the staging requirement is to support three sustained loading operations. Although an FSS-load of cargo can be staged on 10 acres, 16 acres are required for sustained loading operations. Of these 16 acres, about 2 acres are required for the staging of the containers for each FSS. The three simultaneous ship loading operations will require 48 acres of open staging, of which about 6 acres are dedicated to containers.



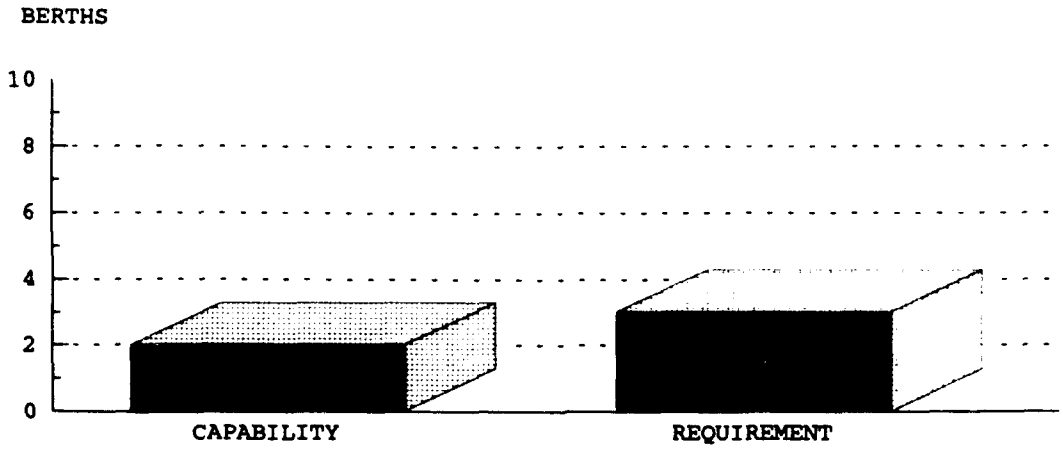
There are 64.1 acres of open staging that could support military operations. The Barbours Cut Terminal has enough staging area for the deployment.

SHIPPING

Although this analysis assumes that only nine FSS-sized ships can deploy the notional armored division, the table below provides ship quantities for the current division size. The number of ships required depends on the shipping mix selected. The best ship mix would consist of all eight FSS ships, plus two Cape H RORO ships.

However, the facilities called for in the *Planning Orders Digest* for the Barbours Cut Terminal can only support the loading of two ships at a time. Each FSS can be loaded in 2 days. To deploy the division in 6 days of shiploading, a third FSS-capable berth is required.

FSS SHIPPING CAPABILITY



UNIT MOVEMENT REQUIREMENTS
ARMORED DIVISION

Minimum Containerization				
All FSS*	8.00	1.93		
FSS and Cape H	6.69	3.00		
All Breakbulk			37.88	
Maximum Containerization				
FSS and Container	7.95			2.00
FSS, Cape H, and Container	4.67	3.00		2.00
Breakbulk and Container			29.61	2.00

*Only 8 FSSs are available. Unit shipping requirements exceed the capacity of these 8 vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

Legend:

RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, 91.

SUMMARY

The Port of Houston receiving capabilities and staging area can support the deployment; however, the berthing restrictions of the FSS vessels limit the port to two FSS support systems. Additional berthing space is required. The armored division cannot deploy in the 6-day shiploading period, using the Planning Orders facilities.

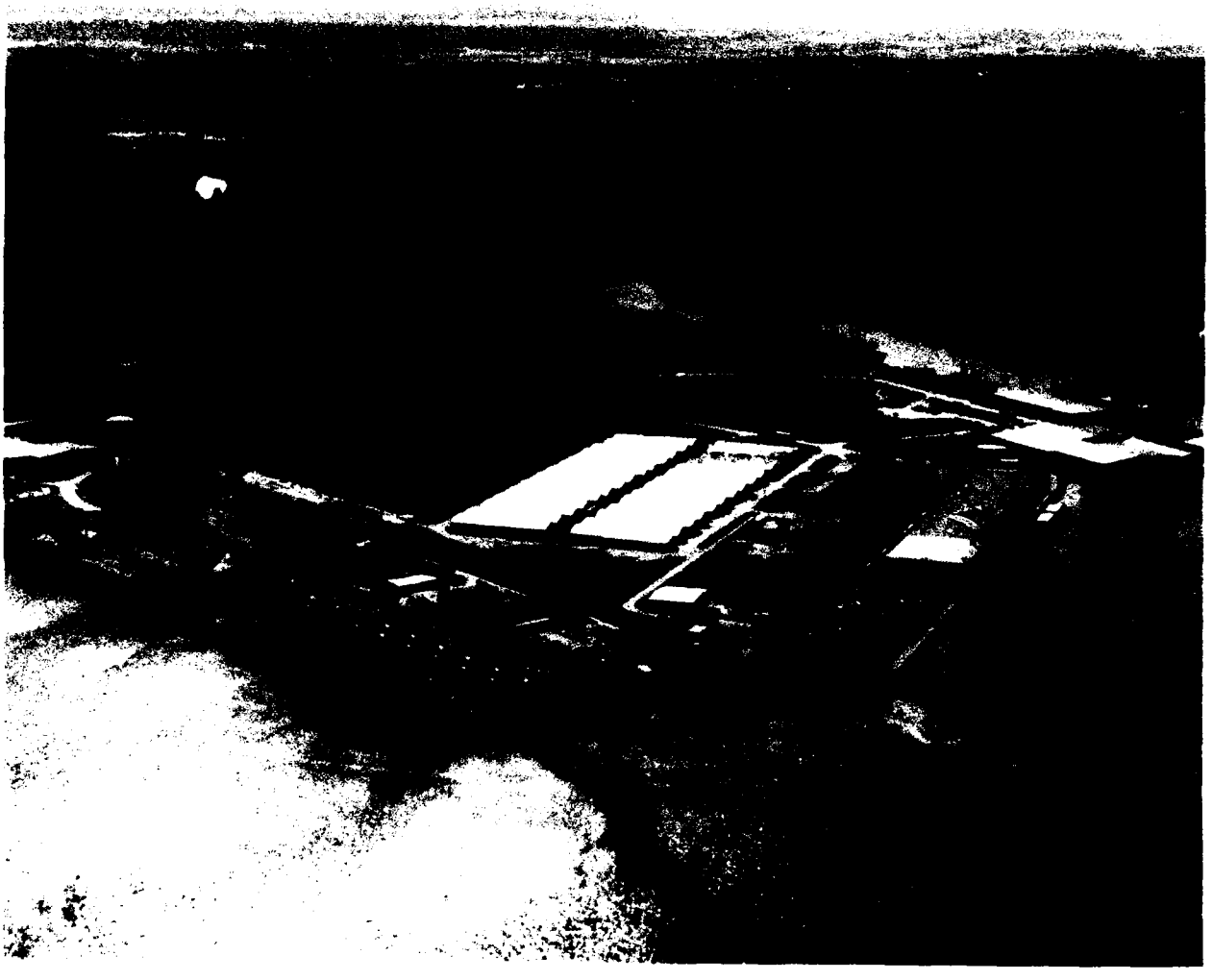
RECOMMENDATIONS

1. Designate only two brigades to deploy through the Port of Houston because of berth limitations of the current Planning Orders.

2. Designate Barbours Cut Terminal berths 1, 2, and 3 and 48 open acres of staging area for long-term use to support three FSS vessel systems. Designate the loading area and berthing space of berth 4 for short-term use to provide the additional berthing space required.

PORT OF LAKE CHARLES

LAKE CHARLES, LOUISIANA



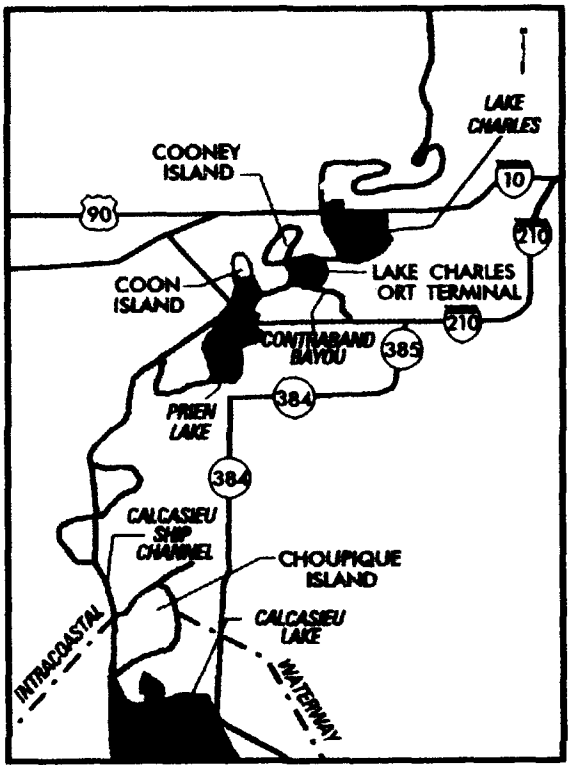
I. GENERAL DATA

TRANSPORTATION ACCESS

WATER

The Port of Lake Charles, in southwest Louisiana, is about 59 miles east of Beaumont, Texas, about 32 miles from the Gulf of Mexico, and is on the east side of the Calcasieu River. From the Gulf of Mexico, the approach is by way of the Calcasieu River Ship Channel.

From the Louisiana shoreline to the port, the channel is 400 feet wide and 40 feet deep at mean low water (MLW). A 1,200- foot turning basin is 5 miles south of the port. According to standard Navy operating procedures, ships do not normally turn in areas that are less than 1.5 times the length of the ship.



Water Access

The only bridge obstruction is for Interstate Route 210, about 1.5 miles south of the port. It has a vertical clearance of 135 feet above mean high water (MHW).

The Gulf Intercoastal Waterway intersects the ship channel 12 miles south of the port. This east/west waterway connects with the Mississippi River System in New Orleans through a series of locks.

HIGHWAY

Highway access, with at least a 16-foot vertical clearance, is available from Interstate Route 10, via the I-210 loop. From I-210, vehicles take Lake, Sallier, and Marine Streets to reach the port gates. Sallier and Lake Streets have four lanes, but Marine Street has only two lanes. Very little congestion exists along this 2.5-mile route from I-210.

All access gates to the port are on Marine Street. Trucks may access Main Gate at any time. Two auxiliary gates, north and south of Main Gate, are operational, as needed, to provide access to the port.

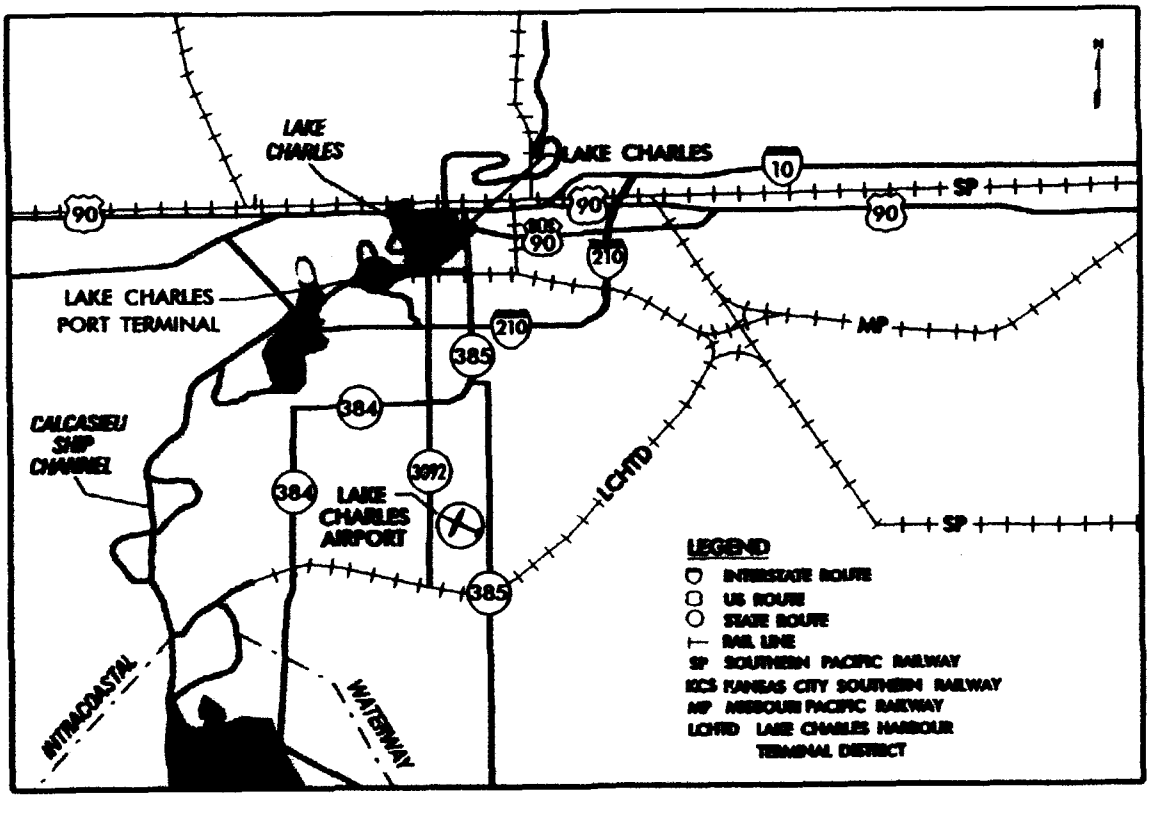
RAIL

The port owns and maintains its own track system. The 38 miles of track directly connect with the Union Pacific (UP) Railroad, which performs railcar switching services on port track as well as service to and from the port terminal. Two other railroads - the Kansas City Southern (KCS) and the Southern Pacific (SP) Railroad Companies - also provide rail service within the Lake Charles area. These railroads and the UP have reciprocal switching agreements. All carriers have railyards near the port.

AIRPORT

The nearest airport is the Lake Charles Municipal Airport. It is about 7 miles south of the Port of Lake Charles and has two commercial runways. The longest runway is 6,500 feet long and 150 feet wide.

Chennault Industrial Airpark is about 7 miles from the Port of Lake Charles. The concrete runway is 15,000 feet long and 200 feet wide. Details of this facility are in the marshaling section of this report.



Highway, Airport, and Rail Access

PORT FACILITIES

BERTHING

The Port of Lake Charles is a major breakbulk and bulk terminal consisting of 10 berths. Wharf construction is typically concrete decking with timber bulkheads. Lighting is sufficient for night operations.

Figure 1 is a land-use map of the main cargo terminal at the Port of Lake Charles. Figure 2 is an aerial view and includes a table identifying berth characteristics.

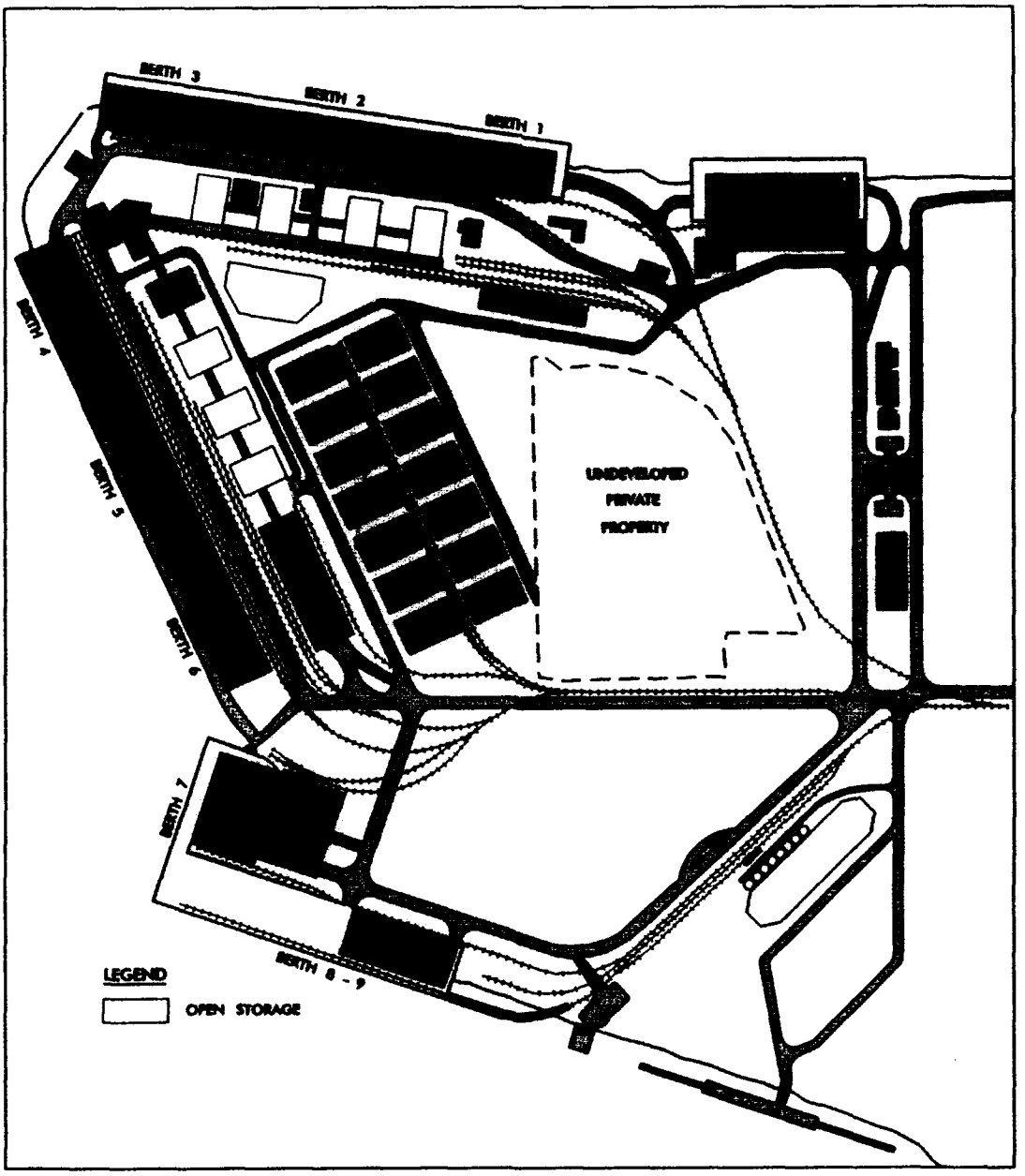


Figure 1. Land-use map.

BERTH CHARACTERISTICS

Length (ft)	1,528	1,599	577	962	597
Depth alongside at MLW (ft)	35	35	35	35	35
Deck strength (psf)	500	500	850	500	1,100
Apron width (ft)	30	30	51	140	40
Apron height above MLW (ft)	14	14	14	14	16
Number of container cranes	0	0	0	0	0
Number of wharf cranes	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No
Apron length served by rail (ft)	0	1,599	0	940	0

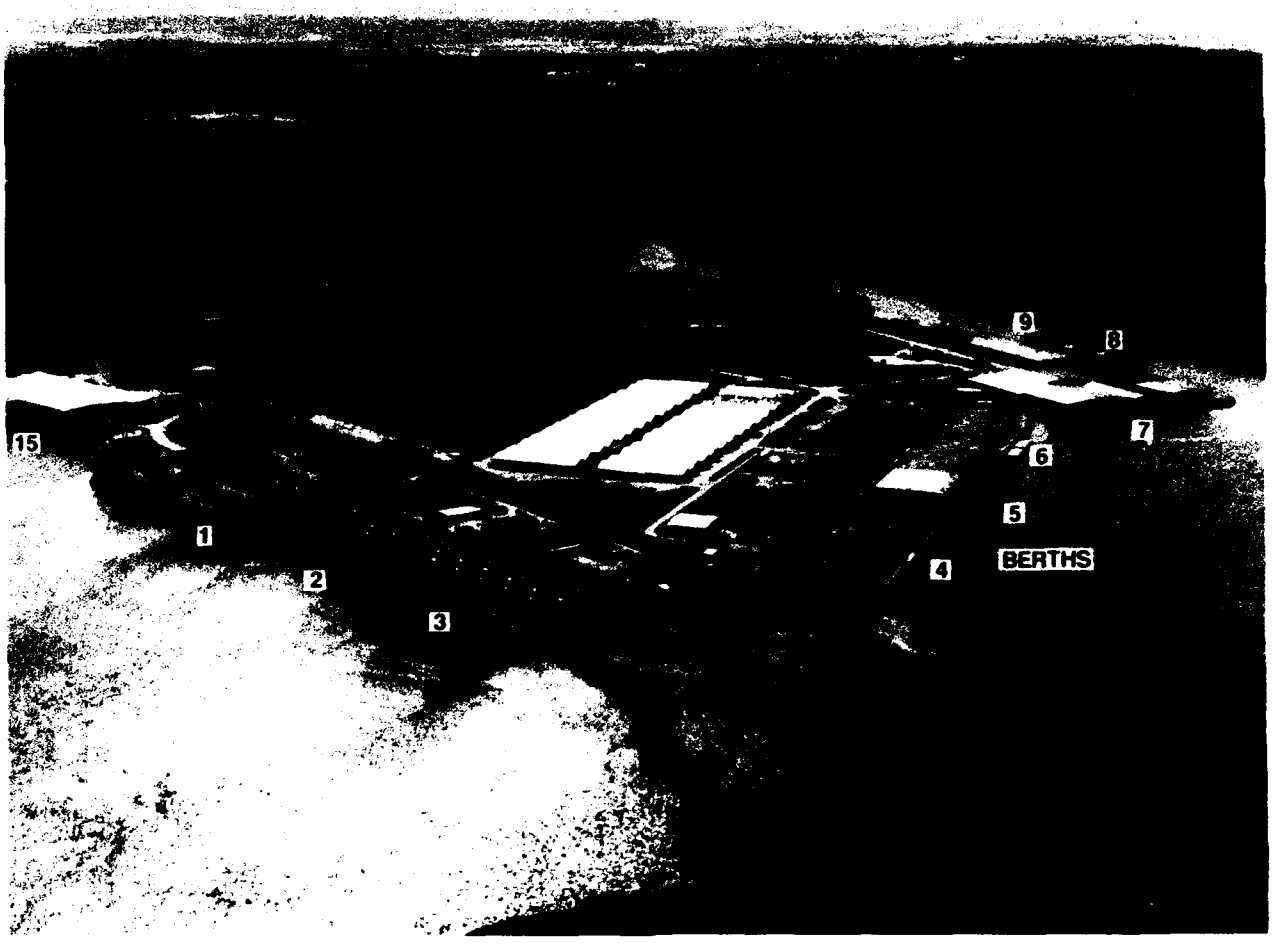


Figure 2. Port facilities.

The port also has a unique barge loading facility about 12 miles south of the port terminal on the Industrial Canal. The terminal has one berth, which is 200 feet long, with a depth of 14 feet MLW. The berth was designated to accommodate the Trailer Marine Transport fleet of nine ocean-going RORO barges, which operate weekly to San Juan, Ponce, and Mayaguez, Puerto Rico.

Trailer Marine Transport Barge Loading

STAGING

Open Staging

The Port of Lake Charles has about 1.9 acres of paved open staging (fig 1). This area is at berth 8 and usually stages palletized general cargo. Fifteen acres of limestone-covered area is behind transit shed 9. Two other areas each have 5 acres of grass-covered area.

Open Staging Areas (Berth 8)

Helicopters should ferry to the port early during the deployment and land on the apron at berth 8-9. Shed 9 can support shrink-wrapping and reduction operations. Helicopters should remain in the shed to clear the apron for the future staging of vehicles.

Covered Storage

Nine transit sheds provide 860,000 square feet of covered storage. Several inland sheds provide about 500,000 square feet of additional covered storage area. Most of this storage is in warehouses 1 through 14.

RAIL

Rail trackage links the railyards to the apron track transit sheds and port storage tracks. Apron tracks are along berths 8 and 9 (fig 1).

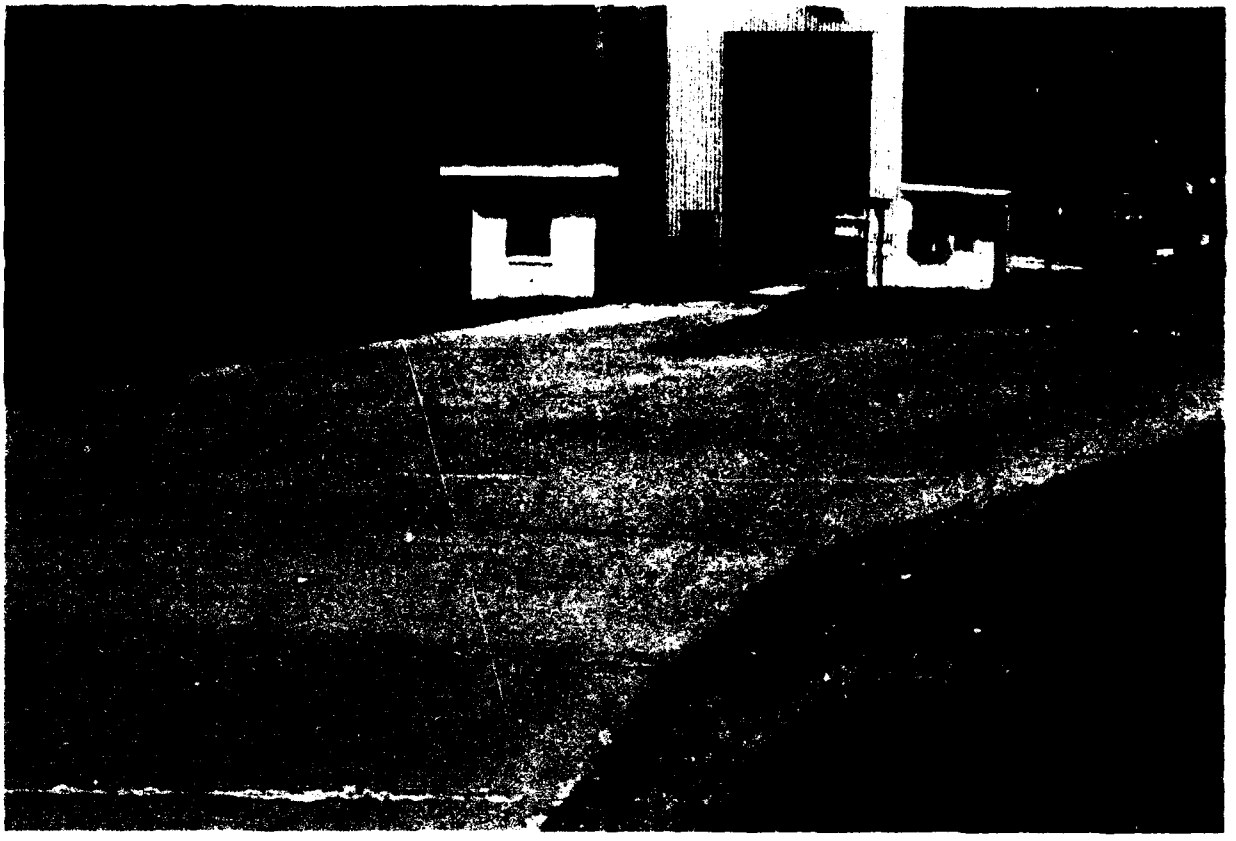
The port owns and maintains about 200,000 feet of track and can store about 700 railcars. Most of the track can support unloading and loading operations. Additional railyards in the local area provide about 130,000 feet of track.

Railyard (Warehouses 1-14)

HIGHWAY

Main Gate has two lanes for each direction of traffic. North and South Gates have one lane for each direction. All roads within the port are two laned and paved, with no clearance restrictions.

The port has one truck scale at the bulk facility east of berth 9.



Truck Scales

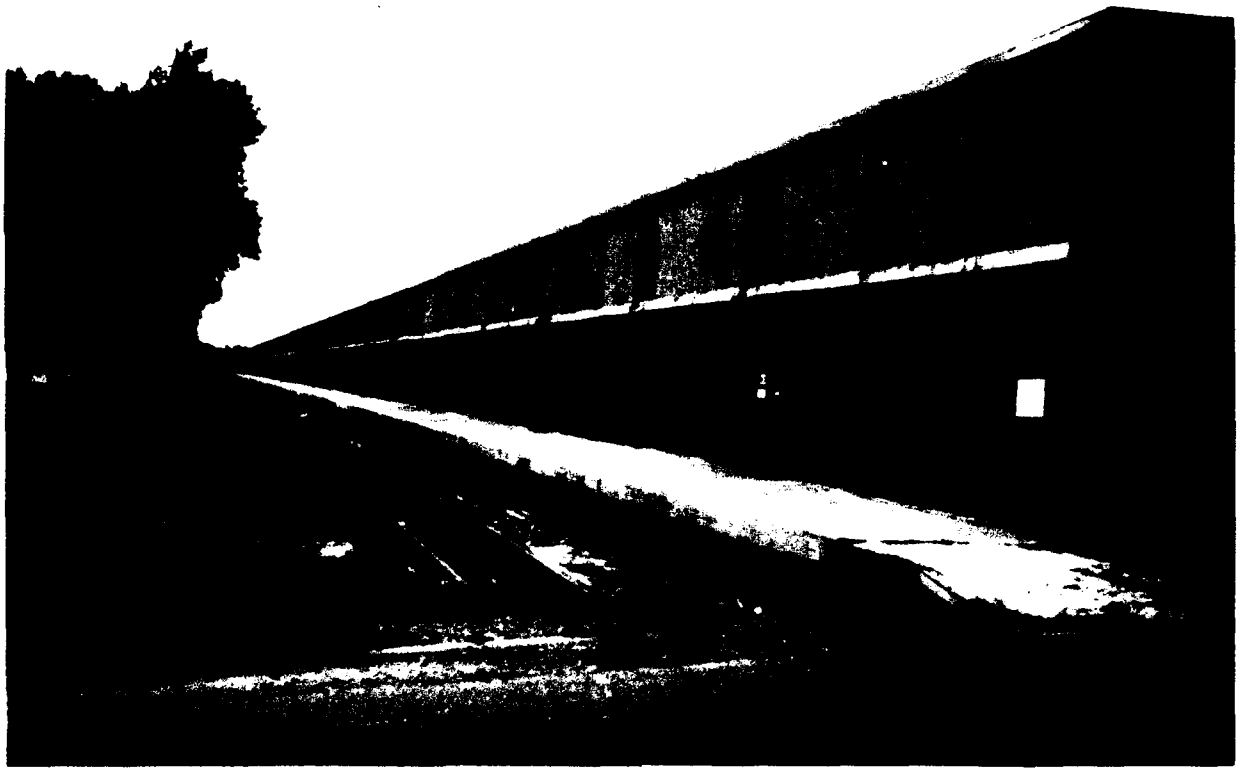
UNLOADING/LOADING POSITIONS

Ramps

The port has two permanent end ramps at berth 7. The port owns one portable end ramp. Other portable end ramps can be rented or constructed to greatly improve the circus-style loading capability.

Docks

All transit sheds and warehouses have truck-level docks, which permits about 30 trucks to unload.



Platform Level Tracks (Sheds 4-6)

Two parallel, platform-level tracks run behind berths 1-3, 4-6, and 8. Single platform-level tracks run behind berths 9 and 15. These platforms provide about 160 railcar handling positions.

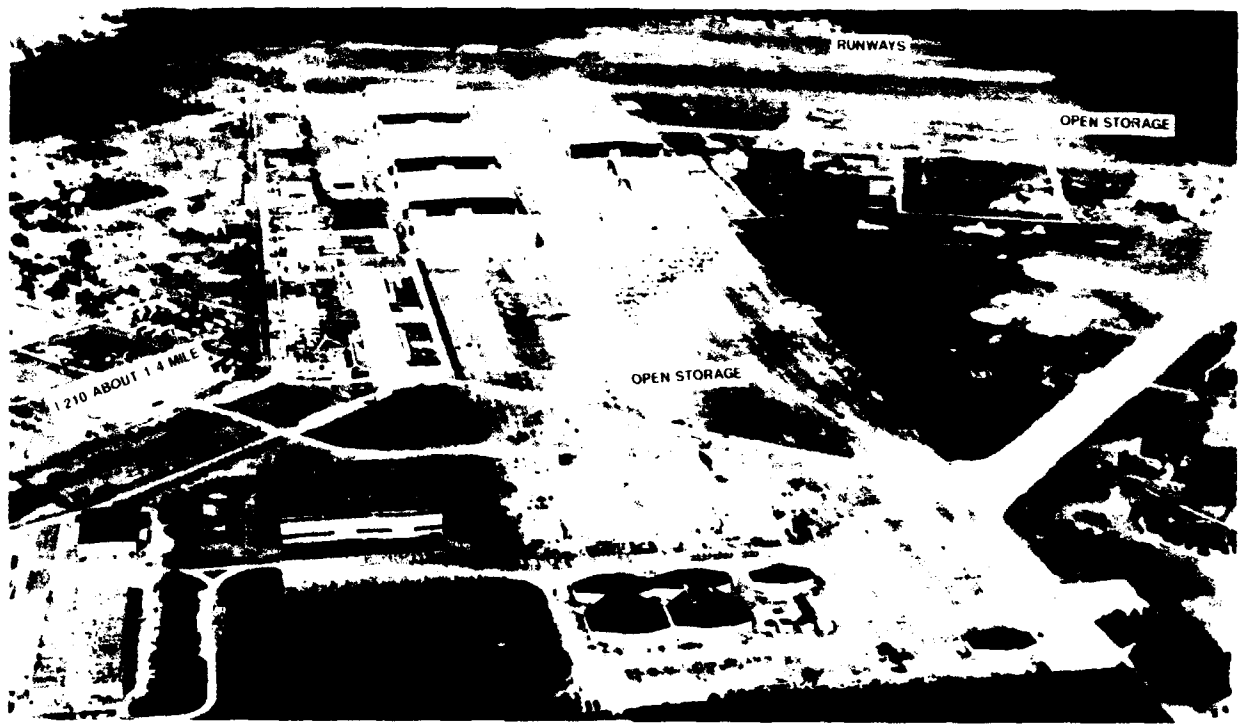
MARSHALING AREAS

Within Port

No marshaling areas are within the port. All the open area within the port is required for staging.

Outside Port

Chennault Industrial Airpark is about 7 miles to the east of the port of Lake Charles. Formerly a bomber base, this 1,000-acre area currently supports aircraft refurbishing and manufacturing activities. About 100 acres of paved, open area is available, but most of the 927,000 square feet of hangar space is leased. All utilities (electricity, drainage, potable water, and compressed air) are available. Seven-foot fencing and closed-circuit TV provide security.



Chennault Industrial Airpark (Eastward View)

The industrial park is bordered by rail lines on the east and south sides. No rail spurs are available to support end ramp offloading.

MATERIALS HANDLING EQUIPMENT (MHE)

The port does not own any cranes. Several mobile cranes, with capacities up to 150 tons, are available from local stevedore companies.

INTERMODAL FACILITIES

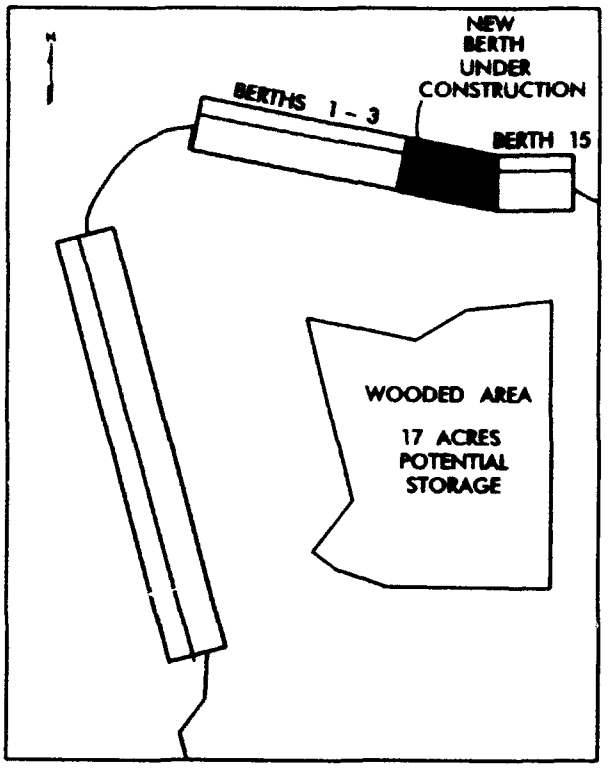
No intermodal operations are at the port or in the Lake Charles area. The nearest intermodal railyards are in Houston, Baton Rouge, and Alexandria. Each of these cities is 80 to 125 miles from the port.

FUTURE DEVELOPMENT

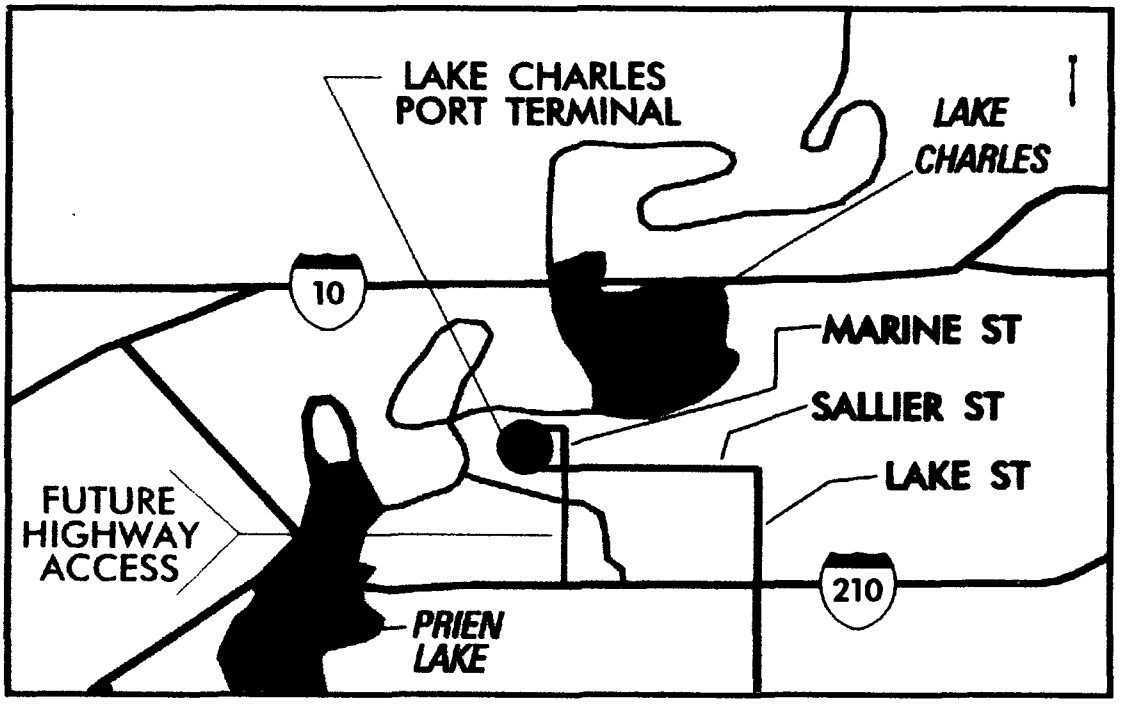
The port began developing the area between berths 15 and 1 in early 1993. The port expects the new shedded apron to be operational in 1995, with a 1,100 pounds per square foot rating.

The port expects to develop the 17-acre wooded area in the center of the port into additional, or open, storage. Clearing will not begin for several years. Once cleared, this area might provide additional staging area.

The port plans to develop a direct-access route to I-210. The plans include the construction of a new interchange on I-210 and a two-lane road from the interchange to the port. The construction of the interchange is scheduled for 1994.



Proposed Berth and Potential Storage

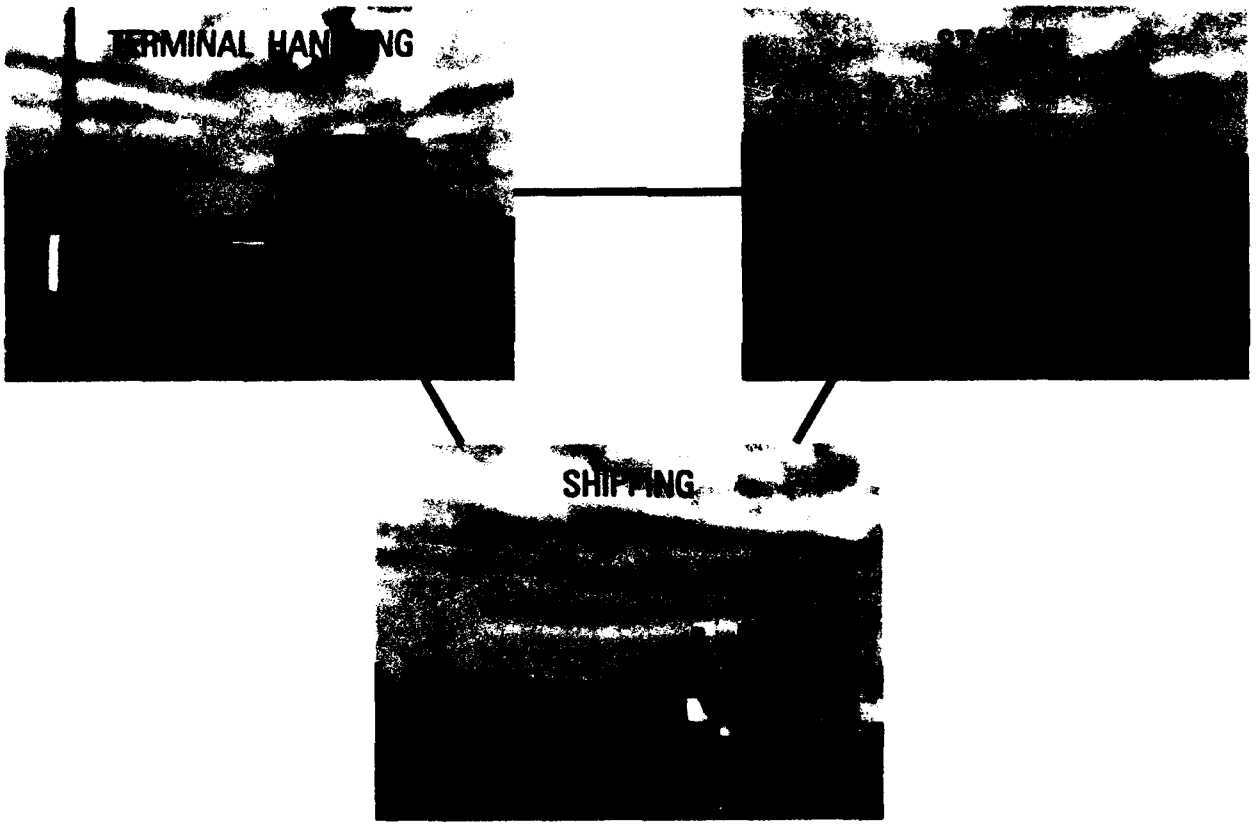


Proposed Highway Access

II. THROUGHPUT ANALYSIS

GENERAL

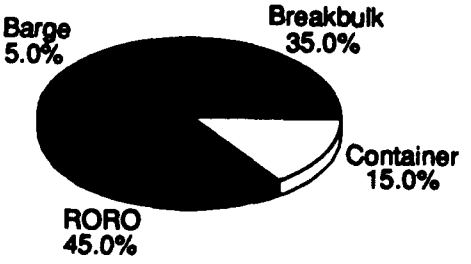
This section evaluates the theoretical throughput capability of the Port of Lake Charles using the port operational performance simulator (POPS) computer model. The model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/handling - in short tons (STON) per day.



Terminal Throughput Subsystems

The analysis assumes that 80 percent of the port facilities will support military deployments. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.

SHIP MIX PERCENTAGES



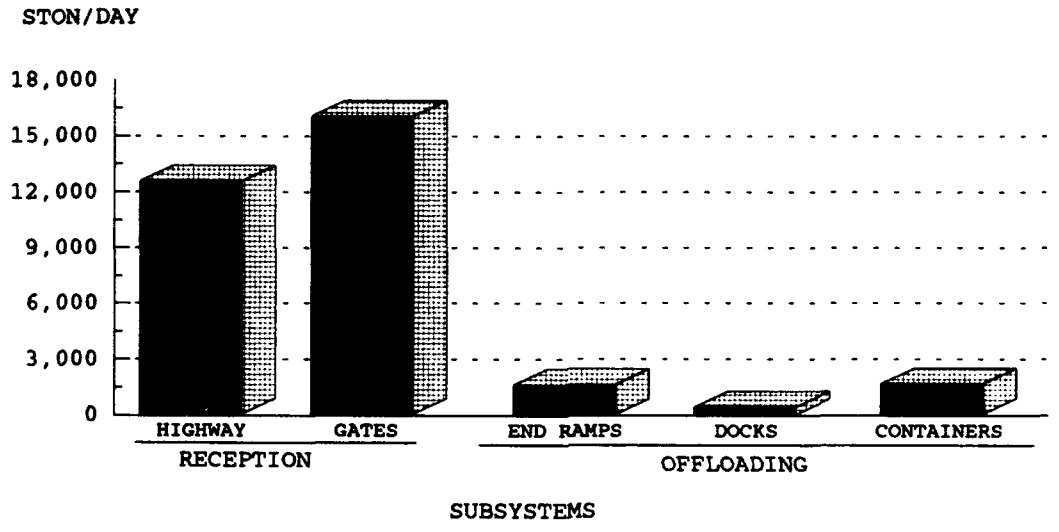
TERMINAL RECEPTION/ HANDLING

HIGHWAY

The port can open two gates, if necessary, to provide three gates for the military and commercial traffic entering the port. Trucks must use Sallier Street to access all gates. Two gates require further traveling on Marine Street (fig 1). All gates provide access to the staging areas. The road network in and out of the port, including the gate processing of vehicles, could handle more than 12,500 STON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to the staging area. Vehicles on commercial or military flatbed trailers without integral ramps will offload at one of the transit shed truck docks. One dock, used as an end ramp, can offload 1,600 STON of rolling stock per day. Supplies in van semitrailers will proceed to the remaining 10 transit shed truck docks. These 10 truck docks can offload about 400 STON of van semitrailer-shipped material and equipment per day. Containers on trucks will move to the staging area for offloading. A container handler can offload 1,626 STON in containers from their chassis per day.

HIGHWAY RECEPTION/HANDLING CAPABILITY



RAIL

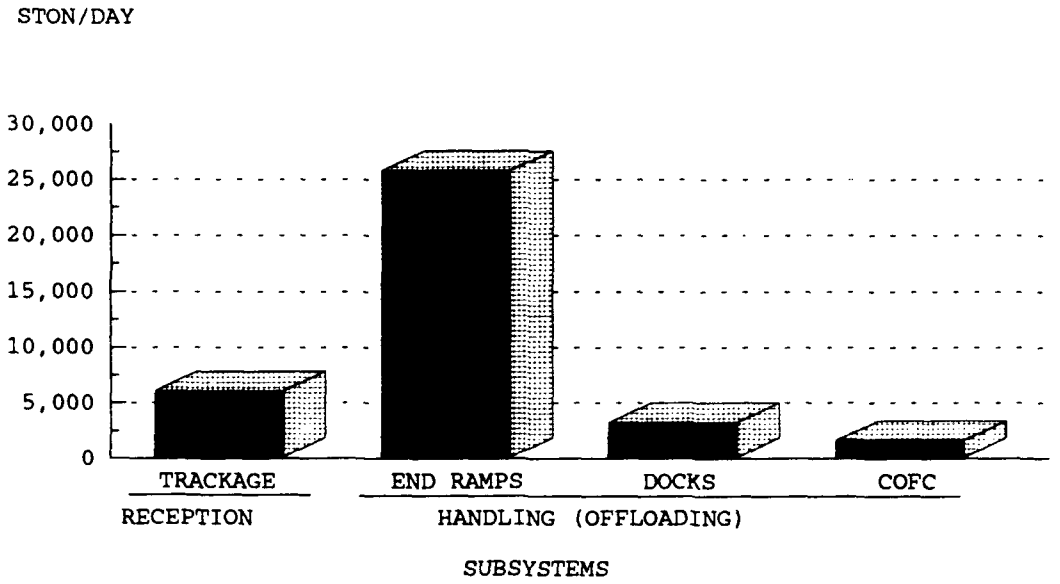
Rail reception at the port is very good. Three commercial carriers provide access to the port. Railyards within the port can store 700 railcars. Also, commercial railyards within a few miles of the port can store more than 2,000 additional railcars. The current rail service to the port is about three 50-railcar trains per day.

POTENTIAL PORTABLE END RAMP LOCATIONS AND LENGTHS

Behind sheds 4-6 (2 ramps total)	16 each
Inland of warehouses, behind sheds 1-3	8
Between warehouses (3 ramps total)	8 each

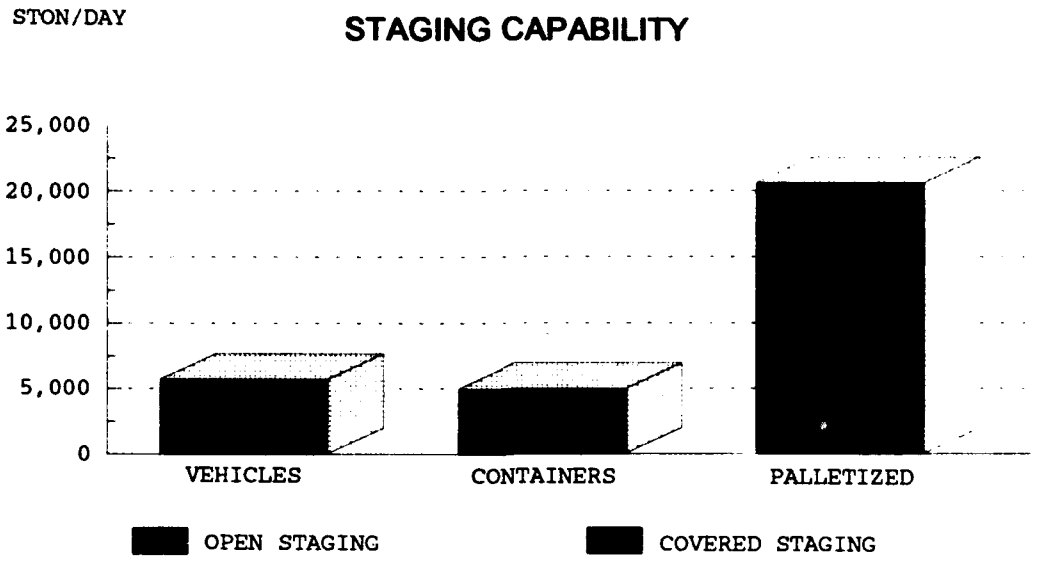
Vehicles on flatcars could offload at eight tracks within the port by using two permanent and six portable end ramps. Boxcars could offload at any of several transit sheds. This analysis allocated the tracks behind sheds 1-3 and 15 for boxcar operations. This arrangement could support about 80 flatcars and 32 boxcars. Containers could offload using a container handler.

RAIL RECEPTION/HANDLING CAPABILITY



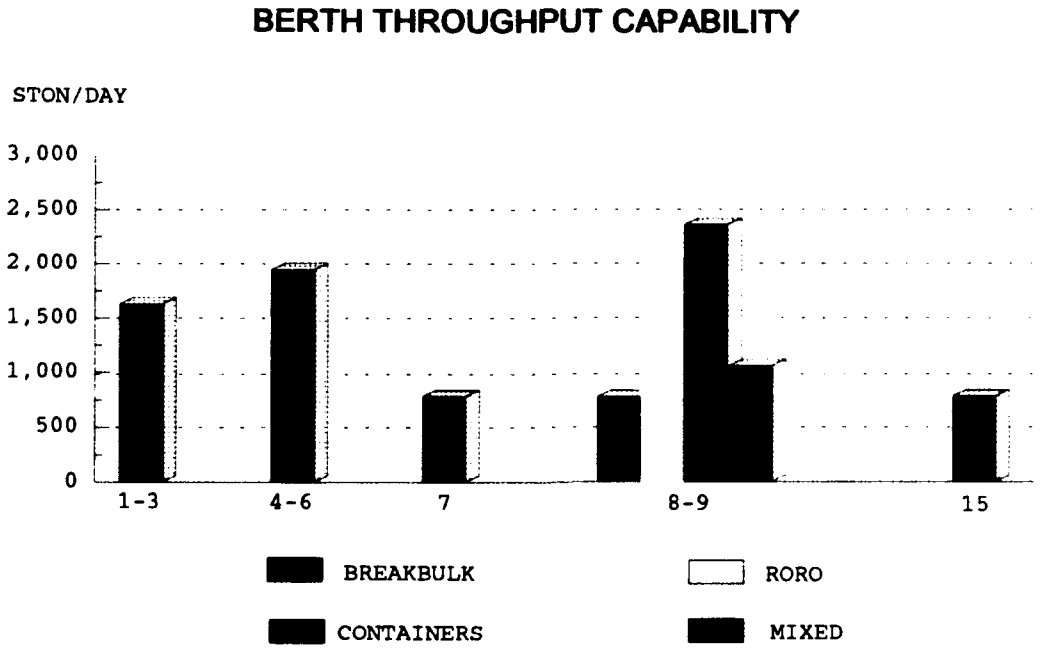
STAGING

The port has about 25 acres of open area to use for staging. It also about 1,360,000 square feet of covered storage.



SHIPPING

We identified the throughput capability per berth in STON per day for breakbulk, RORO, container, and mixed vessels. These results were based on various factors and included MHE used, loading, operational and berth usage rates, as well as berth/ship compatibility.



The berthing capabilities for various vessel types are shown in the table 1. The table also provides the limitations that can hinder shipping operations.

The type of ship preferred at each berth is based on the methodology described in appendix A. The evaluation is based on a snapshot view of the current physical characteristics of the berths and the MHE available. The evaluation gives no considerations to enhancements, such as equipment.

Berth 8-9 provides the largest throughput capacity for container and RORO vessels. This berth is the most compatible for all ship types. The only disadvantage of berth 8-9 is that it is too short to support more than one ship.

PERFERENCE BERTH SELECTION

Breakbulk	3	1	4	2	5
RORO	-	-	-	-	-
Container	-	-	-	1	-

Note: Berths marked "-" are not recommended for these operations.

TABLE 1
SUMMARY OF LAKE CHARLES BERTHING CAPABILITIES

Breakbulk					
C3-S-33a	3	3	1	1	1
C3-S-37c	2	3	1	1	1
C3-S-37d	2	3	1	1	1
C3-S-37a	2	3	1	1	1
C4-S-1a	2	2	1	1	1
C4-S-1qb and 1u	2	2	1	1	1
C4-S-58a	2	2	1	1	1
C4-S-65a	2	2	1	1	1
C4-S-66a	2	2	1	1	1
C4-S-69b	2	2	c	1	1
Seatrain					
GA and PR-class	2	2	1	1	1
Barge					
LASH C8-S-81b	1	1	c	1	c
LASH C9-S-81d	a	a	a,c	a	a,c
LASH lighter	10	11	4	6	4
SEABEE C8-S-82a	a	a	a,c	a	a,c
SEABEE barge	7	8	2	4	2
RORO					
Comet	d,o	d,o	d,o	d,i,j	d,o
C7-S-95a/Maine-class	b	b	b,c	1	b,c
Ponce-class	b,h	b,h	b,c,h	h	b,c,h
Great Land-class	b,h	b,h	b,c,h	h	b,c,h
Cygnus/Pilot-class	b	b	b,c	1	b,c
Meteor	d,o	d,o	d,o	d,i,j	d,o
AmEagle/Condor	b	b	b,c	i,j	b,c
MV Ambassador	d	d	d	d	d
FSS-class	b	b	b,c	1	b,c
Cape D-class	b	b	b,c	i,j	b,c
Cape H-class	a,b	a,b	a,b,c	a	a,b,c
Container					
C6-S-1w	2,e	2,e	c,e	1,e	c,e
C7-S-68e	2,e	2,e	c,e	1,e	c,e
C8-S-85c	1,e	1,e	c,e	1,e	c,e
Combination					
C5-S-78a	2,e	2,e	c,e	1,e	c,e
C5-S-37e	2,e	2,e	c,e	1,e	c,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

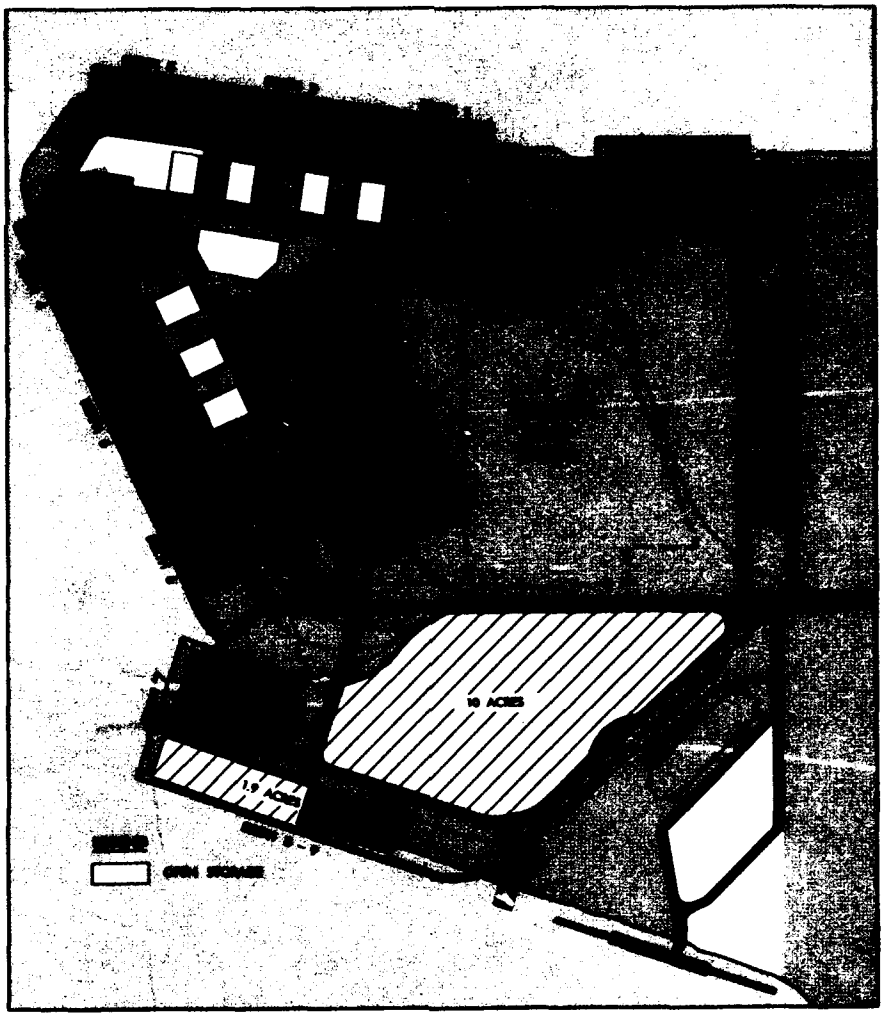
Note: Ramp clearance and ramp angle based on maximum vessel draft.

III. APPLICATION

GENERAL

This section of the report will evaluate the throughput capability of the port for deploying a notional mechanized infantry brigade on three FSS ships.

The *Planning Orders Digest*, issued by MARAD, does not include agreements for military use of the Port of Lake Charles. This analysis realistically considers what facilities would efficiently support military operations, in lieu of planning orders. Only berth 8-9 can support RORO operations. The staging for these these two berths can only support the loading of a single FSS. For these reasons, this report analyzes operations at berth 8-9 and considers the 15-acre limestone field for additional staging.



Facilities Used in This Analysis

REQUIREMENTS

The likely requirement for the Port of Lake Charles is to load a notional mechanized infantry brigade in 6 days. The brigade has to move about 2,600 vehicles and 220 containers. The movement of this equipment to the port will require 360 (60 per day) railcars, using the convoy/rail option. Under this option, about 1,220 (205 per day) roadable vehicles would be driven and about 775 (130 per day) would be towed.

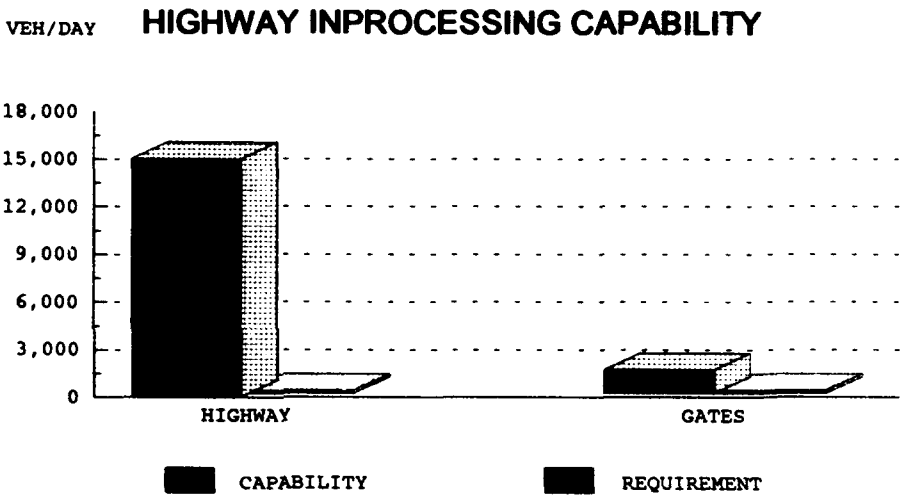
MECHANIZED INFANTRY BRIGADE DEPLOYMENT DATA

Total Equipment	
Volume	91,506 MTON
Weight	31,670 STON
Area	474,300 SQ FT
Vehicles	2,600
Containers (20 ft)	220

TERMINAL HANDLING

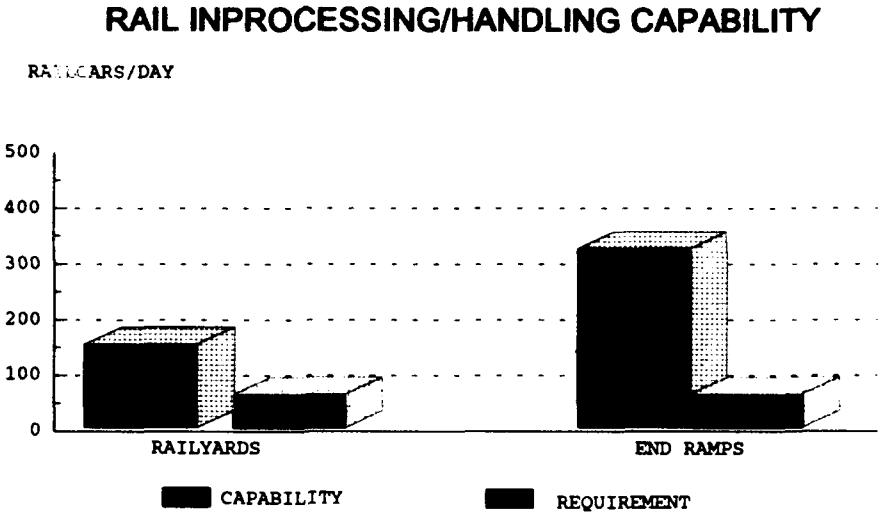
HIGHWAY

Vehicles and containers on chassis would access the port from the Sallier Street Gate. Both the access road and the gate can handle more than 1,500 vehicles per day.



RAIL

The classification yards within the port could receive 150 railcars per day. Also, 8 fixed and portable rail end ramps could offload 80 flatcars every 5 hours, or 320 per day.

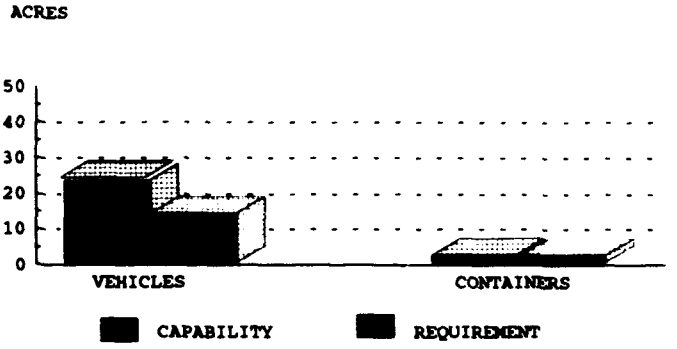


STAGING

This analysis assumes that current downsizing continues and that three FSS-sized ships will deploy an entire notional mechanized infantry brigade. One ship will depart every 2 days. Although an FSS cargo load can be staged on 10 acres, 16 acres are required for a sustained loading operation. Of these 16 acres, about 2 acres are required for staging the containers for each FSS.

About 25 acres of open storage area exist that could support military operations.

OPEN STAGING CAPABILITY



SHIPPING

Although this analysis assumes that only three FSS-sized ships can deploy the notional mechanized infantry brigade, the table below provides ship quantities for the current brigade size. The number of ships required depends on the shipping mix selected. The best ship mix would consist of about 3 FSSs.

UNIT MOVEMENT REQUIREMENTS
MECHANIZED BRIGADE

Minimum Containerization				
All FSS*	3.33			
FSS and Cape H	2.22	1.00		
All Breakbulk			12.57	
Maximum Containerization				
FSS and Container	2.64			0.67
FSS, Cape H, and Container	1.54	1.00		0.67
Breakbulk and Container			9.86	0.67

*Only 8 FSSs are available. Unit shipping requirements exceed the capacity of these 8 vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

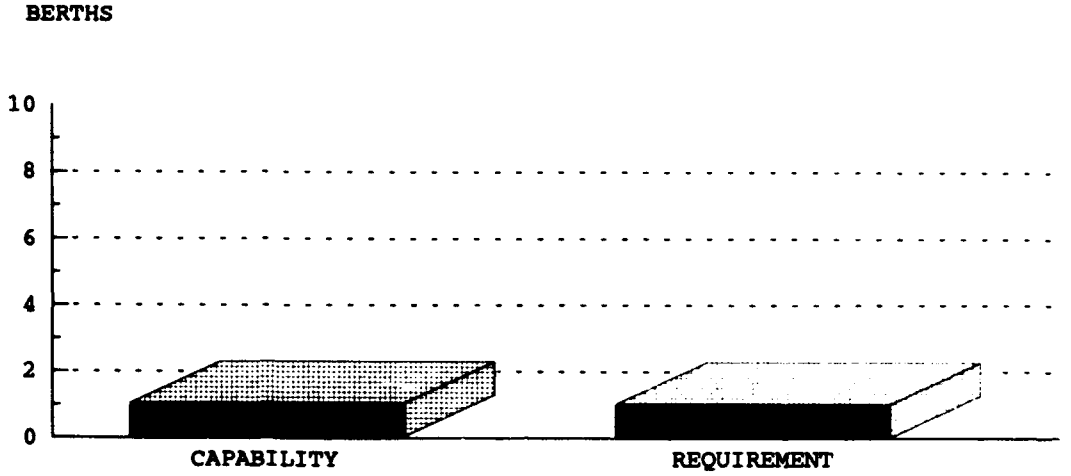
Legend:

RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, 91.

FSS SHIPPING CAPABILITY



SUMMARY

The berthing restrictions of the FSS vessels limit the Port of Lake Charles to one FSS support system. The port receiving and staging capabilities can support FSS operations. The mechanized infantry brigade can deploy in the 6-day outloading period.

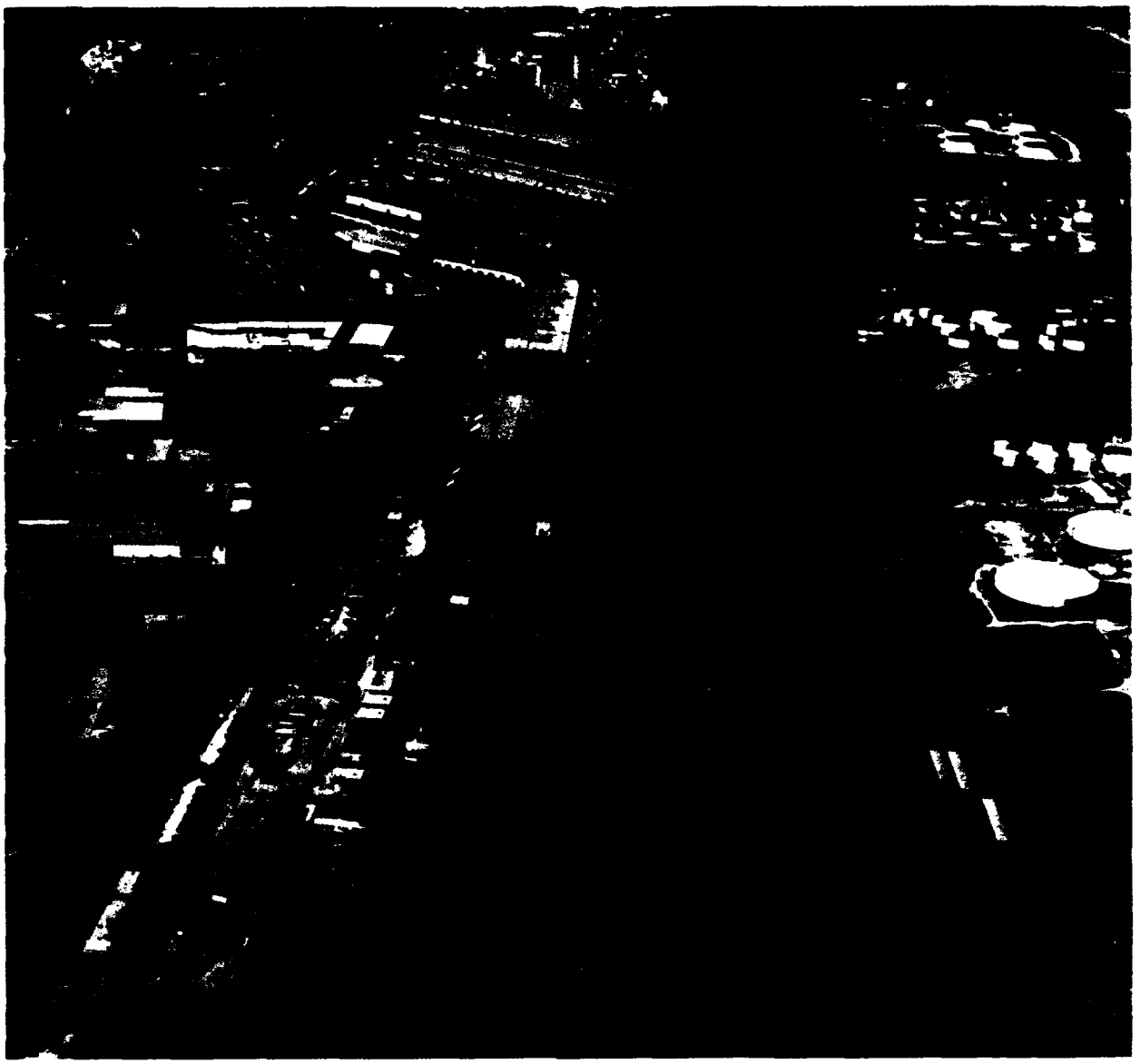
RECOMMENDATIONS

1. Designate only one brigade of equipment to deploy through the Port of Lake Charles, because of the berthing and staging limitations.

2. Designate berth 8-9, and 14 additional acres of staging, to support the one FSS system.

PORT OF MOBILE

MOBILE, ALABAMA



I. GENERAL DATA

TRANSPORTATION ACCESS

WATER

The Port of Mobile, Alabama, is at the junction of the Mobile River and the head of Mobile Bay. The major port facility is the Alabama State Docks (ASD). This facility is along the last 5 miles of the Mobile River, mainly on the south bank. Mobile Bay is about 29 miles long and about 8 miles wide at its upper portion. The bay is separated from the Gulf of Mexico by Dauphin Island and the Mobile Point Peninsula. Between these two points of land is a 3-mile-wide access way into the bay.

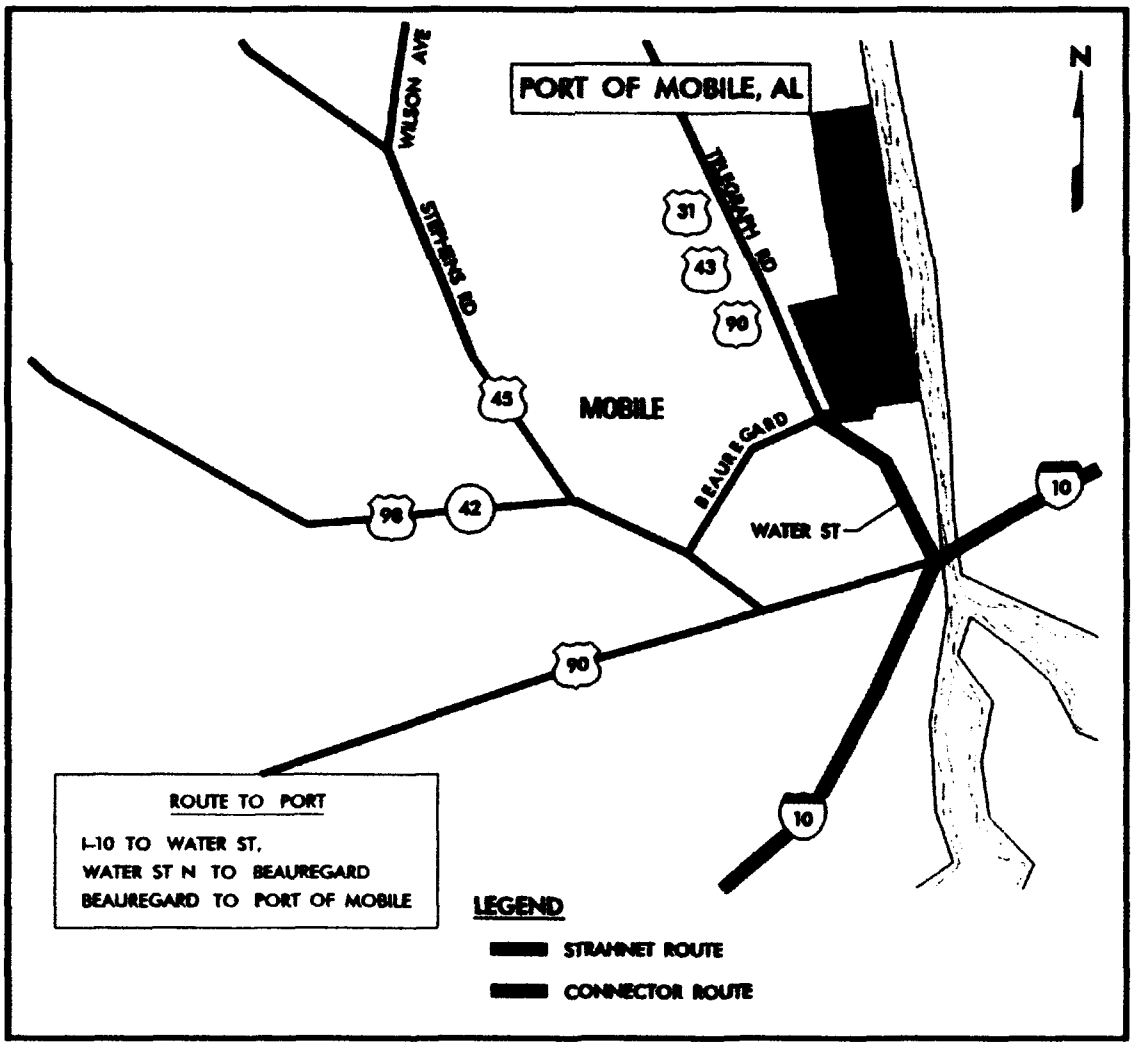
Passage from the Gulf of Mexico to the Port of Mobile is via a series of ship channels. These channels vary from 40 to 42 feet deep and 400 to 775 feet wide.

Opposite the terminal is a 2,500-foot-long by 1,000-foot-wide and 40-foot-deep mean low water (MLW) turning basin. No overhead restrictions exist between the Port of Mobile and the Gulf of Mexico.

Water Access to ASD

HIGHWAY

Access to a number of interstate and US routes to and from the ASD is excellent. Interstate Routes 10 and 65 and US Routes 31, 43, 45, 90, and 98 are all near the terminal. Port entry from these routes is by way of Water Street to Beauregard Street and Beauregard Street to the main gate. Beauregard Street has a raised flyover above the railroad tracks, so traffic flow to the port is not impeded by rail movements. The highways leading into the port have a vertical clearance restriction of 14 feet 6 inches. The highway network around the port area has heavy traffic congestion during peak hours.

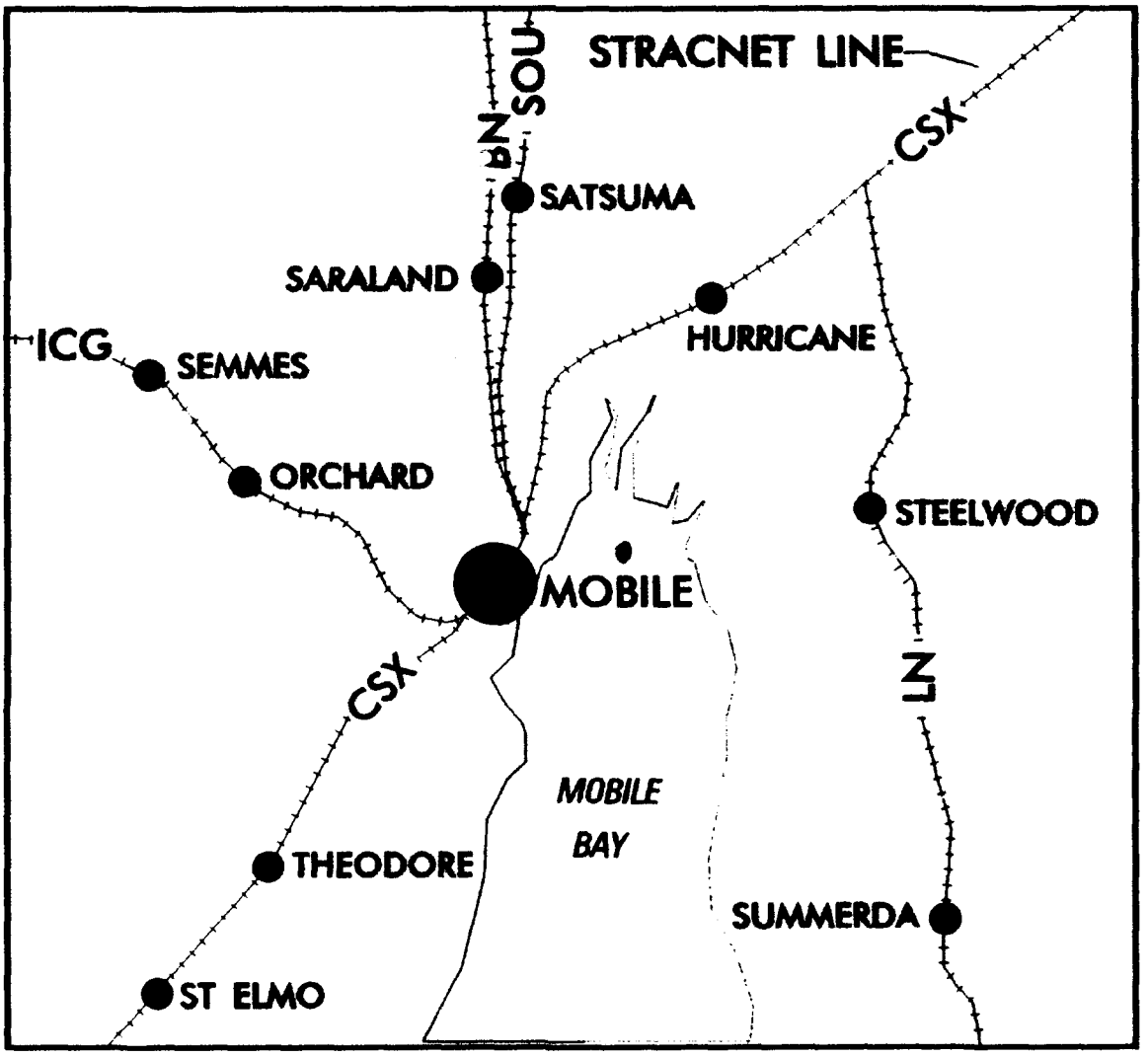


Highway Access

RAIL

Four railroad companies provide one track each to the Port of Mobile. These are the Burlington Northern (BN), CSX, Illinois Central, and Norfolk Southern. The tracks are active and in good condition. All four rail lines have clearance restrictions of 40 feet in the vertical direction and 22 feet in the horizontal direction. Each of the railroads has a regional railyard less than one-half mile from the port. The capacity of the railyards ranges from 1,025 to 1,800 89-foot railcars (1,600 to 2,800 60-foot railcars). The port operates four railyards. They are the Joint Interchange (Terminal Yard), Main Yard (A, B, C), McDuffie Terminal, and Frascati Yard. The capacity of these yards ranges from 300 to 1,300 railcars.

The ASD terminal railway handles all rail movements and switching within the port complex. It offers shipside service and is responsible for switching cars from the four major railroads to various State dock facilities.

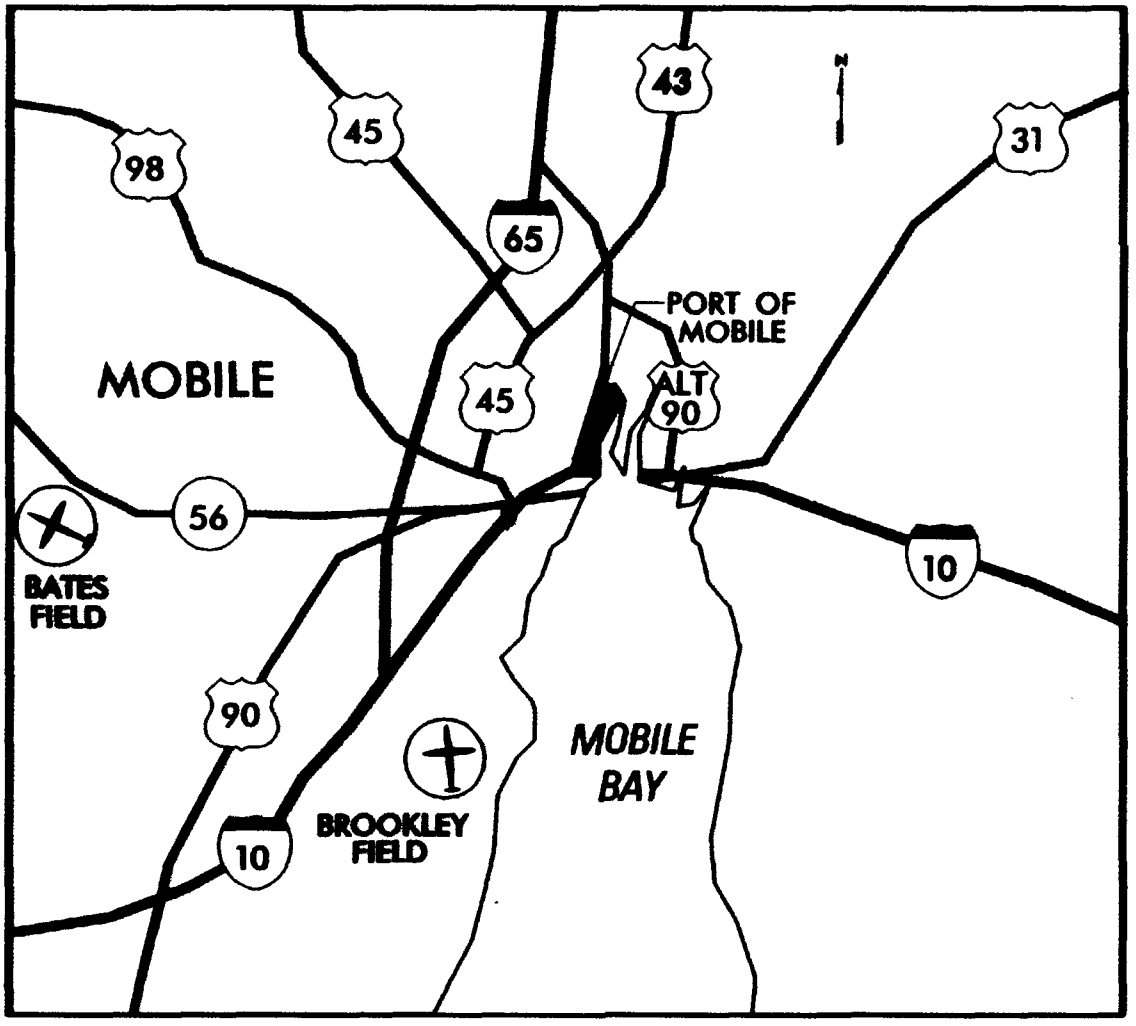


Rail Access

AIR

Two airports serve the Port of Mobile: the Mobile Municipal and the Brookley Industrial Complex and Airport. The Mobile Municipal Airport, or Bates Field, is on Airport Boulevard, about 12 miles west of the port. Bates Field has three runways. The dimensions of the runways are 4,354 by 150 feet, 4,988 by 150 feet, and 8,527 by 150 feet.

The Brookley Industrial Complex and Airport, or Brookley Field, is 5 miles south of the Port of Mobile. The complex has two main runways and numerous taxiways. The dimensions of these runways are 9,600 by 200 feet, and 8,600 by 150 feet. Brookley Field is a complete transportation complex with direct interstate connections and two railroads.



Highway and Air Access

PORT FACILITIES

BERTHING

The ASD is a multicargo marine complex comprising a marginal wharf and wide piers. The wharf and piers provide 26 general cargo berths.

Berths 2 through 8 are along the marginal wharf. Berths 2 through 7 provide about 3,540 feet of continuous berthing space. Berths 2 and 5 are open, while berths 3, 4, and 6 through 8 have 30-foot-wide aprons. Depth alongside the berths averages 34 feet MLW, and deck strength is 1,000 pounds per square foot.

Piers A through C range in length from 570 to 1,610 feet. Apron width varies from 42 feet to open. Depth alongside the piers ranges from 27 to 38 feet MLW, and deck strength ranges from 500 to 1,500 pounds per square foot.

In general, wharf and pier construction consists of concrete pile and beams and cross wall-supported concrete decking. The concrete decks front steel, sheet pile, bulkheads and have concrete-surfaced solid fill. All berths are fronted with a timber fendering system.

All berths are well lit for night operations. Gantry and mobile crane assets serve the terminal.

Figures 1 and 2 are aerial views of the port and include a table identifying berth characteristics.

Land-Use Map

BERTH CHARACTERISTICS OF STATE DOCKS

Length (ft)	898	1,006	499	1,138	584	570
Depth alongside at MLW (ft)	32	35	34	34	37	37
Deck strength (psf)	1,000	1,000	1,000	1,000	1,000	1,000
Apron width (ft)	Open	30	Open	30	30	74
Apron height above MLW (ft)	11	11	11	11	11	11
Number of container cranes	1	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	Yes	No
Apron length served by rail (ft)	800	1,000	499	0	0	500

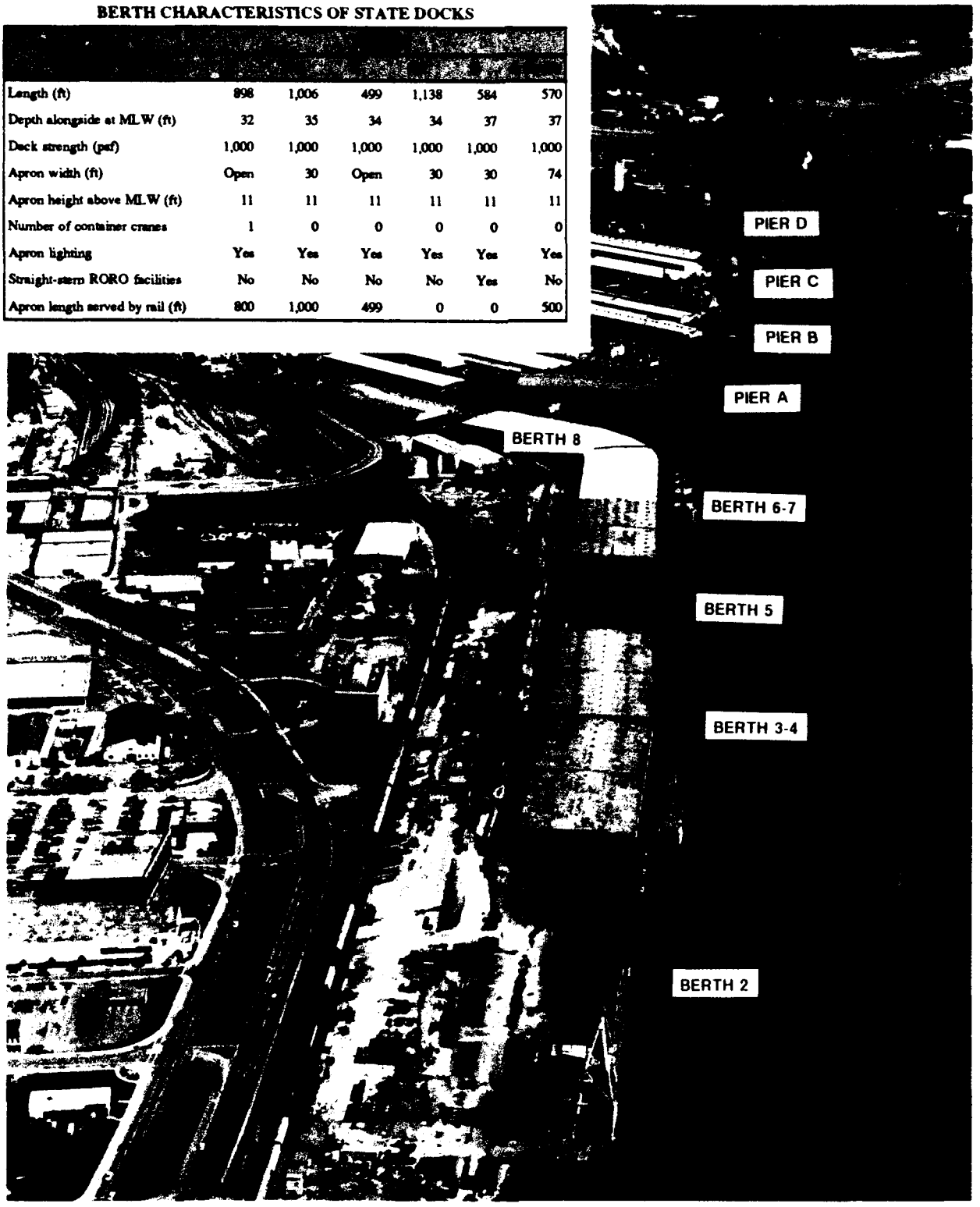
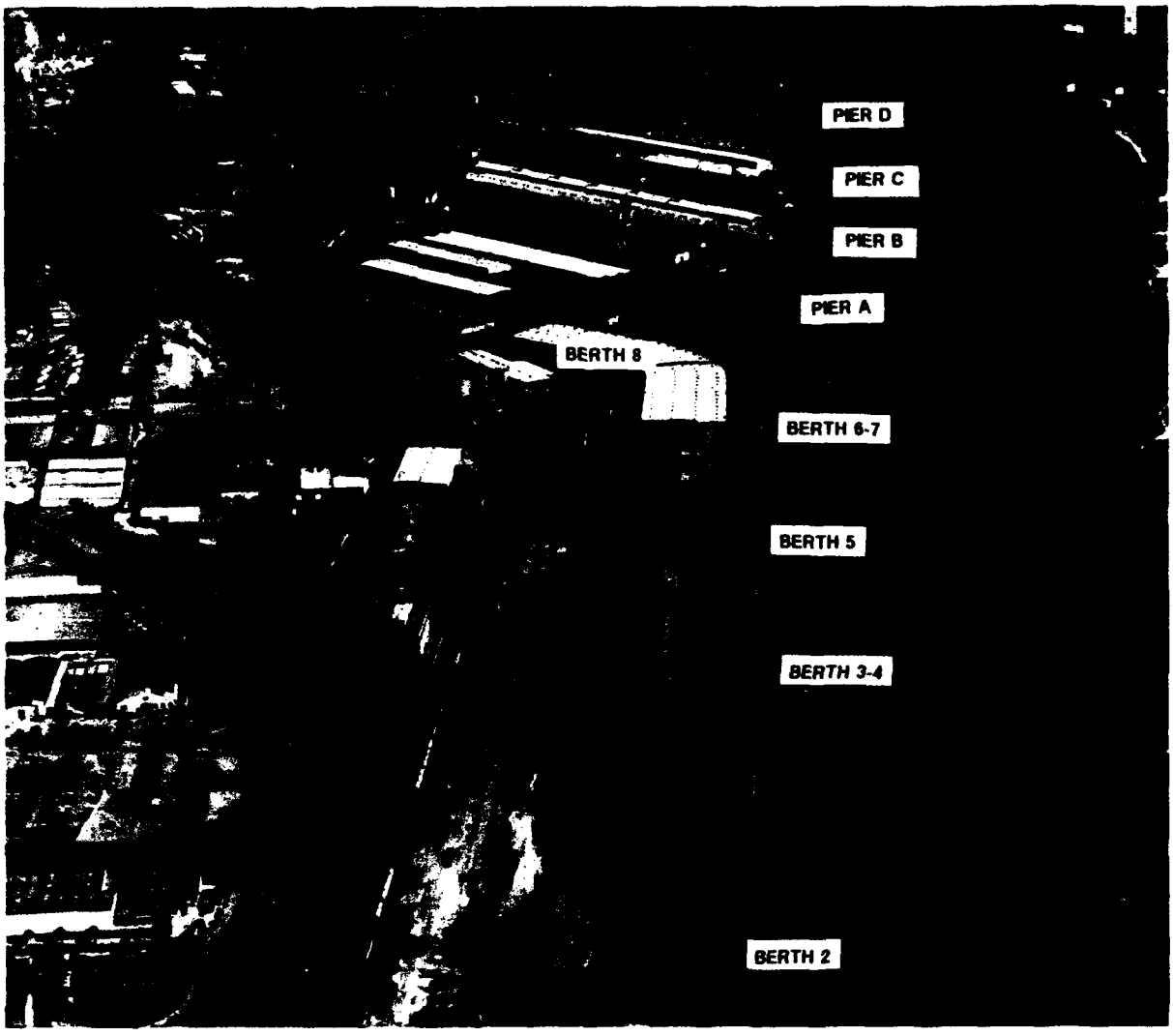


Figure 1. Berths 2-8 and pier A.



BERTH CHARACTERISTICS OF STATE DOCKS

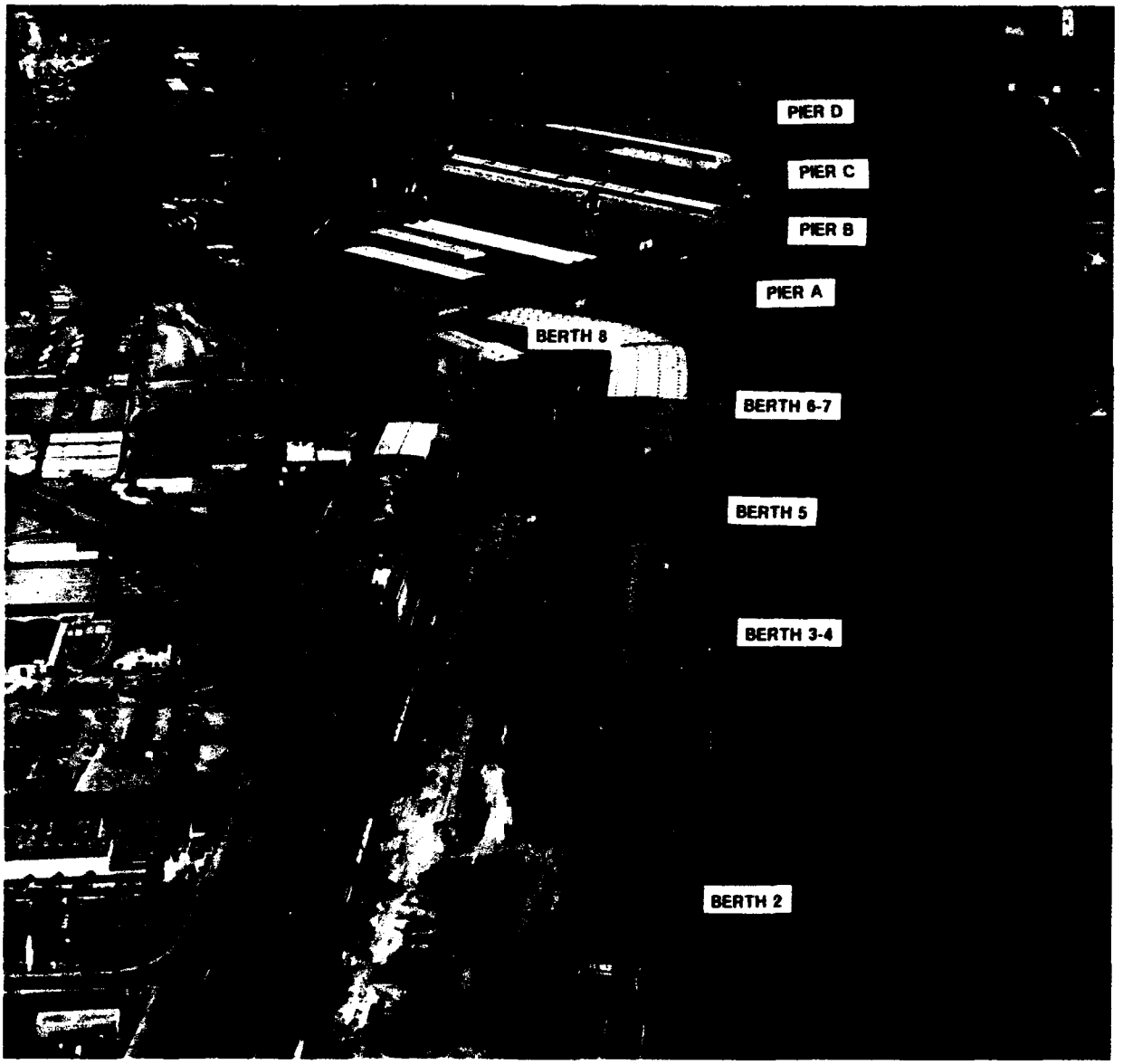
Length (ft)	477	1,025	525	1,007	1,610	650	1,532	820	650	540	463	408
Depth alongside at MLW (ft)	28	35	27	35	38	28	37	36	33	33	35	37
Deck strength (psf)	500	500	500	500	500	500	500	1,500	500	500	500	1,500
Apron width (ft)	42	42	100	100	42	Open	80	Open	100	Open	Open	Open
Apron height above MLW (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Number of container cranes	0	0	0	0	0	0	0	0	0	0	0	0
Number of wharf cranes	0	0	0	0	0	0	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RO/RO facilities	No	No	No	No	No	No	No	No	No	No	No	No
Apron length served by rail (ft)	477	1,000	525	1,000	1,500	0	1,500	400	0	500	463	408

Figure 2. Piers A, B, and C.

STAGING

Open Staging

The Port of Mobile has about 38 acres of paved open storage. One of the single, largest areas is the container marshaling area behind berths 2 through 7. This area has 22 acres of paved, lit, open storage. The open storage is mainly used for containers, lumber, steel, military equipment, rolling stock, rubber, and general cargo. At the west end of pier north C is a 142,500-square-foot open area, with lights, that can be used for helicopter operations. The port has also used the northwest corner of the International Trade Center parking lot for helicopter operations. The International Trade Center parking lot was used primarily for ASD officials during sightseeing tours of the port.



Open Staging Areas

Covered Staging

The Port of Mobile has 13 transit sheds/warehouses that provide 1,774,000 square feet of covered storage.

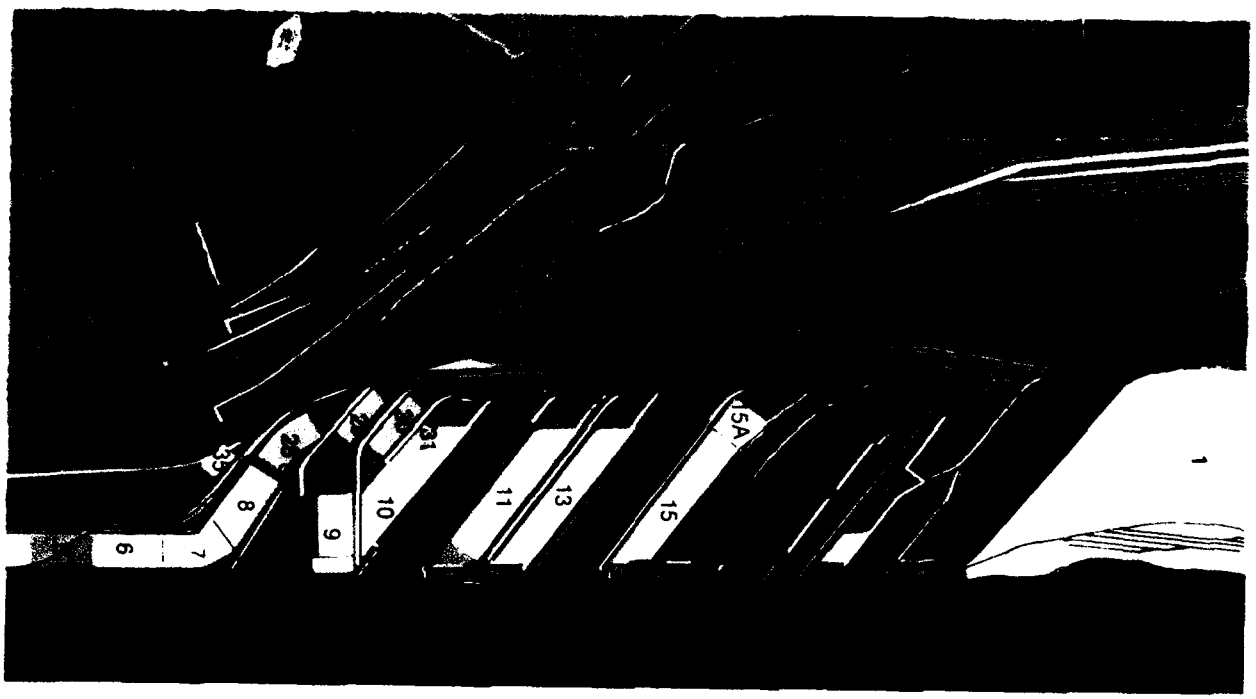
COVERED STORAGE

T-shed 3	100,000	6	11	Plywood
T-shed 4	100,000	6	11	Wood pulp
T-shed 6	100,000	8	6	Plywood
T-shed 7	100,000	2	10	Wood pulp
T-shed 8	68,000	6	8	Lumber
T-shed A south	100,000	2	7	Wood pulp
T-shed A north	153,000	4	12	Lumber/general cargo
T-shed B south	172,000	4	30	Lumber/general cargo
T-shed B north	280,000	6	30	Lumber/general cargo
T-shed C south	360,000	6	36	Lumber/general cargo
Blakeley Island warehouse	153,000	4	7	Lumber/general cargo
Warehouse C/A	50,000	4	7	General cargo
Unit 19	38,000	0	0	Lumber

*As stated in the Port of Mobile survey.

RAIL

An extensive rail network serves the terminal. More than 75 miles of track serve the berths, transit sheds, warehouses, and other port facilities. The port operates its own fleet of 8 diesel engines and 550 boxcars. Railcar switching and movement within the terminal and joint interchange yard are accomplished with Alabama State Docks Terminal Railway engines. All berths and piers, except berths 6 through 8, river B, and Blakeley have apron trackage.



Rail Network on and Adjacent to Terminal

ASD Railyard Locomotive

HIGHWAY

All commercial trucks report to the Alabama State Docks Control Terminal. This terminal is west of the port. After processing, trucks proceed to the main gate. Prior arrangements with ASD can preclude the need for reporting to the control terminal. The main gate has two entry and two exit lanes and is controlled 24 hours a day. Two other gates, Sealand and St. Anthony Street, are available on an as-needed basis.

The Port of Mobile has truck scales available at the grain elevator near pier D. The port uses these scales for weighing shipments of grain. These scales are available for weighing other items if the grain elevator area is not busy.

No clearance restrictions are on the major roads within the port.

Main Gate

UNLOADING/LOADING POSITIONS

Ramps

Berths 5 and south C west end each have a concrete rail end ramp. The port also has two portable, steel, rail end ramps. These end ramps can be positioned throughout the terminal.

The port has about six end ramps available for unloading trucks and truck-tractor/semitrailer combinations.

Portable Rail End Ramp

Docks

All of the transit sheds and warehouses, except unit 19, have rear platform-level rail tracks. Because the Port of Mobile is readily able to specialize in handling cargo requiring covered storage, at least 300 to 350 rail loading positions are available for boxcars.

The Port of Mobile reports that about 58 truck docks could be made available at one time for van offloading operations.

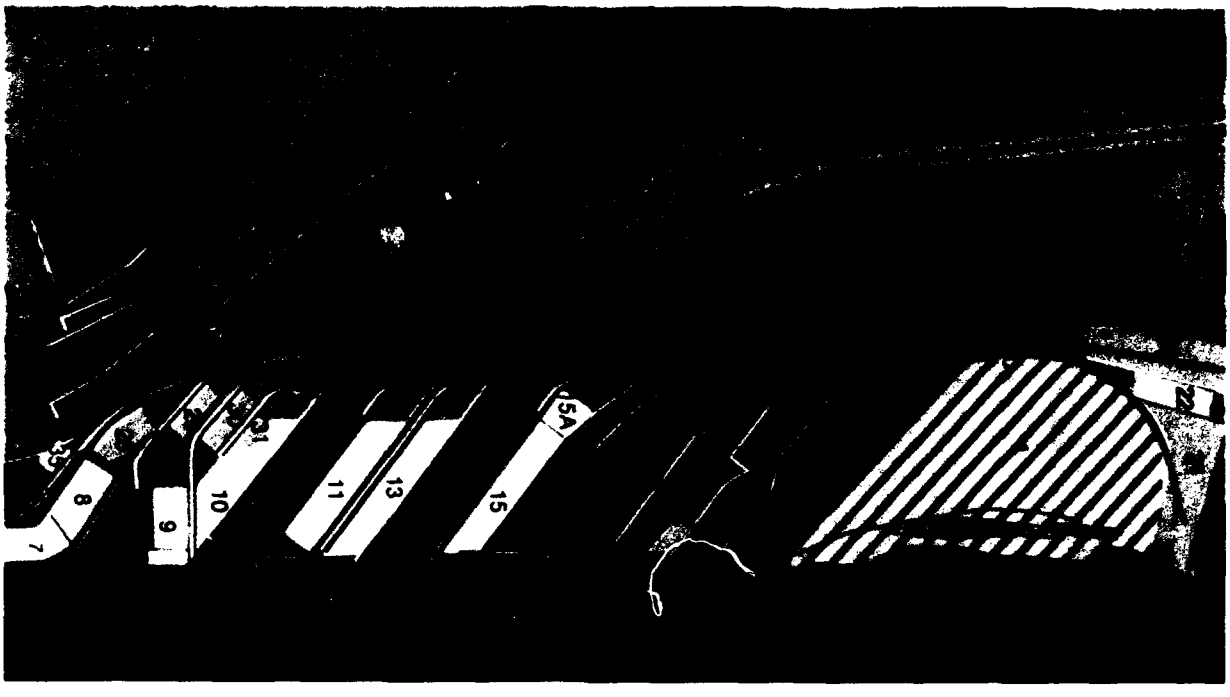
Platform-Level Rail Tracks

MARSHALING AREAS

Two sites could serve as marshaling areas for the ASD. These include the abandoned Aluminum Company of America Complex (ALCOA) and the Mobile Municipal Auditorium.

The ALCOA complex is within the terminal, north of pier D. The complex offers a large, paved parking area and several empty buildings.

The Mobile Municipal Auditorium is about 1 mile from the terminal. It has a 13-acre paved, well lighted, fenced parking lot.



////// MARSHALING AREAS

Potential Marshaling Areas

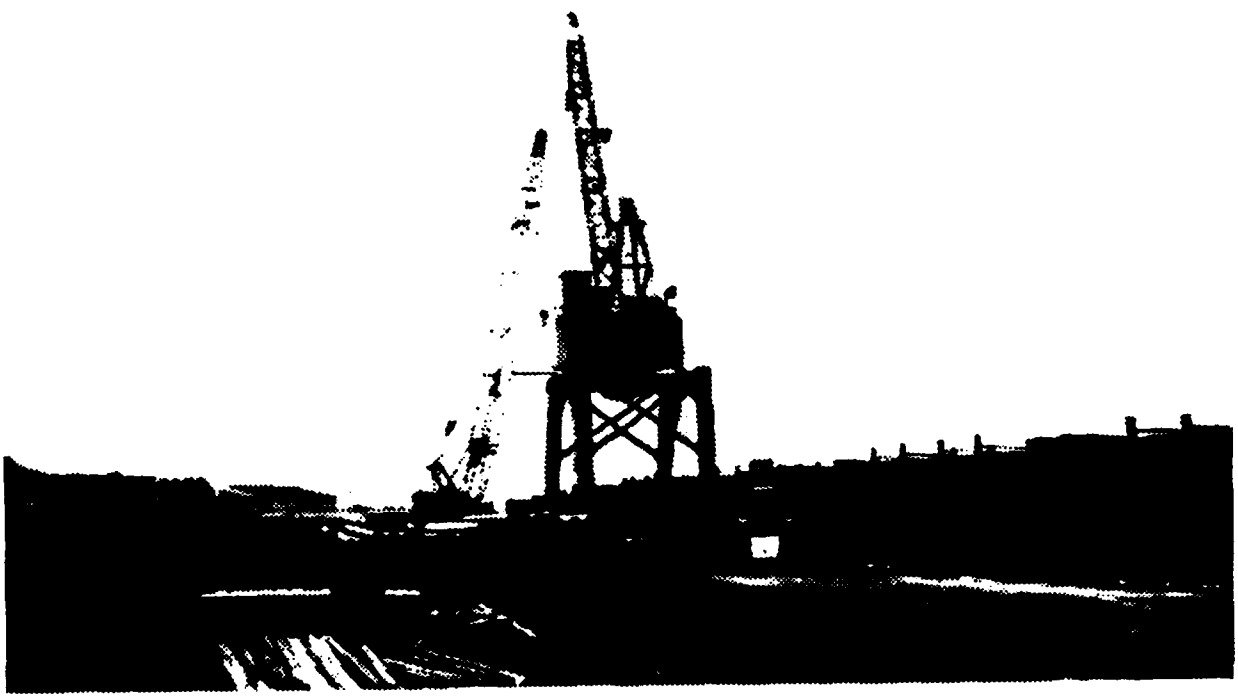
MATERIALS HANDLING EQUIPMENT (MHE)

The port has about 15 types of cranes to move cargo around the facility. Additional cargo handling resources, including heavy-lift equipment, can be readily acquired from any of the stevedoring companies serving the Port of Mobile. Mobile and floating cranes range in capacity from 200 to 500 tons.

MATERIALS HANDLING EQUIPMENT (MHE)

Container crane	45	1
Wharf crane	45	1
Mobile crane	35	1
Mobile crane	40	1
Mobile crane	60	1
Mobile crane	70	1
Mobile crane	90	1
Mobile crane	100	1
Mobile crane	140	1
Mobile crane	160	1
Floating crane	25	1
Floating crane	80	1
Gantry crane	50	2
Gantry crane	22.5	1
Container lift	35	1
Container lift	40	1
Container lift	46.6	1
Forklift	1.5-35	258

Container Crane



Wharf and Mobile Cranes

INTERMODAL FACILITIES

GENERAL

The two railroad companies that operate truck/railcar intermodal facilities in the Mobile area are CSX and BN.

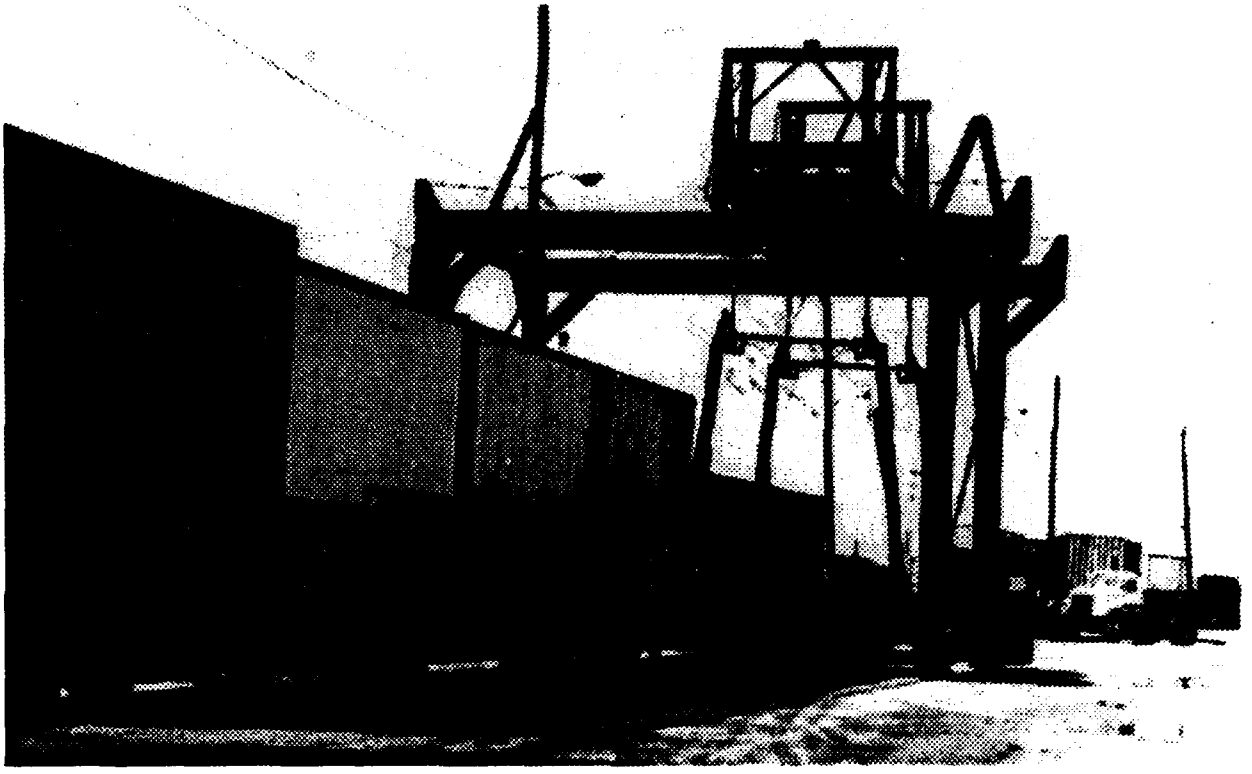
Local Rail Intermodal Facility Locations

BN

The BN intermodal facility is at 701 Telegraph Road. The intermodal yard is situated on 7 acres, with the capability to stage about 175 40-foot truck chassis. Transfer operations are conducted on one track, which can provide a total of twenty-five 89-foot flatcar spots. Container loading operations are conducted using one side loader. BN routinely handles trailers-on-flatcars and double-stacked containers on flatcars. The normal hours of operation are from 0800 to 1700 hours. One portable end ramp is available for circus-style loading of military equipment. The current activity level is about 60 lifts per day. BN replaced the old lift equipment with new equipment as of the end of March 1993. The number of lifts per day is expected to dramatically increase.

CSX

The CSX operates the largest intermodal facility in the Mobile area. This facility is at the end of Industrial Canal Road. This intermodal yard has a parking lot capable of staging 175 40-foot chassis. The yard routinely handles trailers on flatcars and containers on flatcars and is equipped to perform double-stacked container operations. Transfer of containers is conducted on one track, which can handle a total of twenty 89-foot flatcars. The facility performs loading and unloading operations with two gantry cranes. No end ramp is available for circus-style loading of military equipment. Normal hours of operation are from 0700 to 2300 hours weekdays and 0700 to 1500 hours on the weekends. This facility has a capability of about 130 lifts per day.



Intermodal Facility Transtainer

FUTURE DEVELOPMENT

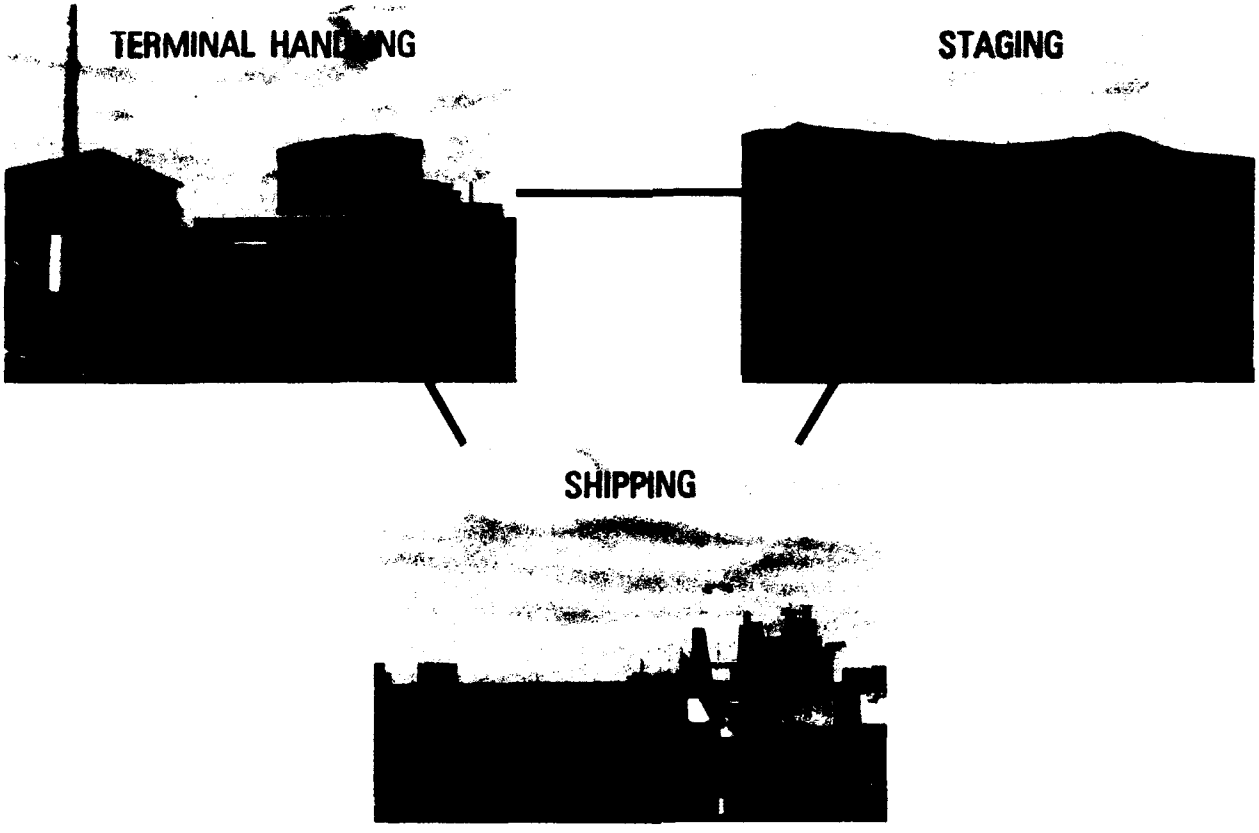
The Port of Mobile intends to construct a new ship berth (berth E) north of the grain elevator and pier D (refer to fig 1). This berth will be a "river end" (berth facing the river) berth, used for the loading of general cargo.

The port has plans for the construction of a new extension to Interstate 65. The proposed route for this extension comes within 1 mile of the Port of Mobile.

II. THROUGHPUT ANALYSIS

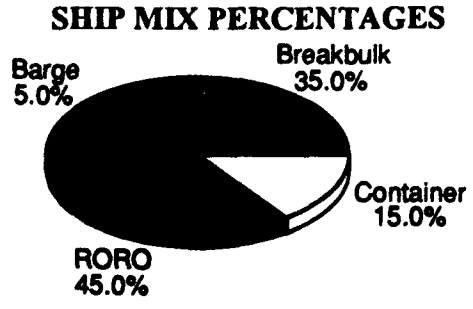
GENERAL

We evaluated the theoretical throughput capability of the Port of Mobile by using the port operational performance simulator (POPS) computer model. The POPS model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least-capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/ handling - in short tons (STON) and measurement tons (MTON) per day.



Terminal Throughput Subsystems

The analysis assumed that 80 percent of the port facilities will support the military deployment. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.



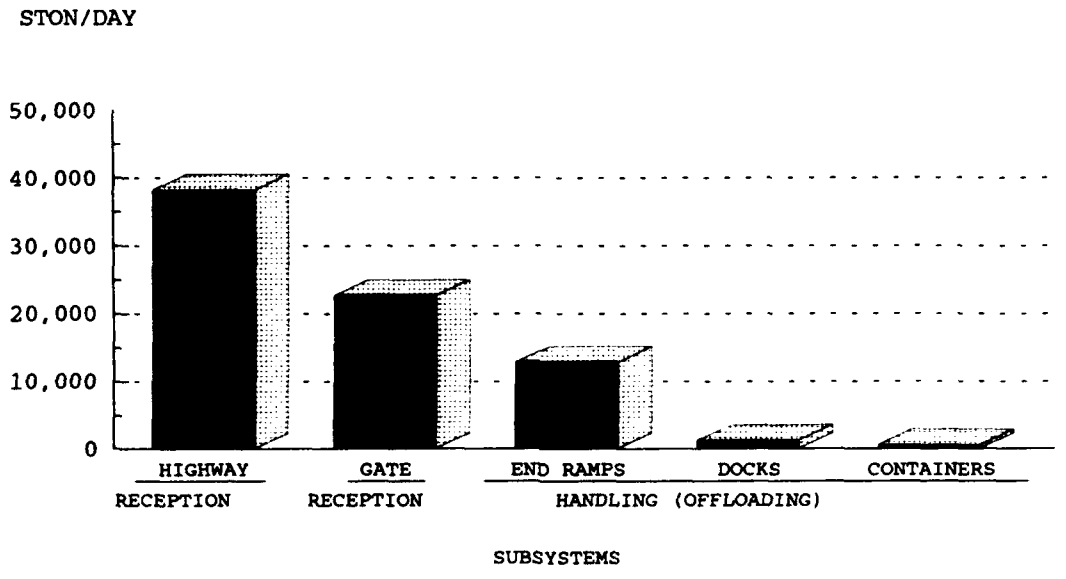
TERMINAL RECEPTION/HANDLING

HIGHWAY

Interstate Routes 10 and 65, Water Street, and Beauregard Street all provide good access to the port. Entrance to the port is provided through the main gate off Beauregard Street. Two other gates are available if they are needed. The port roadways provide access to staging and pier areas from the main gate. The road network in and out of the port, including the gate processing of vehicles, could handle about 22,600 STON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to staging areas. Vehicles on commercial or military flatbed trailers that do not have means for unloading vehicles can offload at six end-ramp areas. Based on the assumption a deploying unit uses 5 end ramps, the end ramps could offload about 12,800 STON per day. Supplies in van semitrailers will proceed to the transit shed docks for offloading. These facilities provide about 58 handling positions. Use of all these positions will provide an offloading capability of about 1,230 STON of cargo per day at these facilities. Containers on trucks can move to staging areas to be offloaded, or directly to the container loading pier. The container handling facility could offload 530 STON of cargo per day.

HIGHWAY RECEPTION/HANDLING CAPABILITY

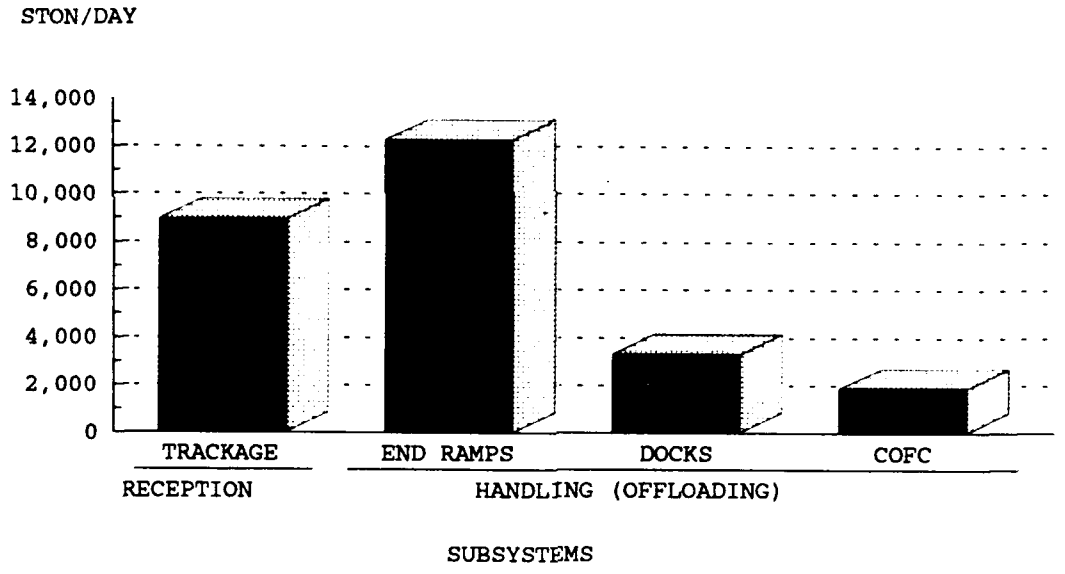


RAIL

Rail reception at the port is very good. Four commercial carriers provide access to the port. Railyards within the port could store more than 2,300 railcars. Also, commercial railyards within one-half mile of the port could store more than 5,425 additional railcars. The port states that they could handle from 60 to 80 railcars per 8-hour period (180 to 240 railcars in a 24-hour period).

Vehicles on flatcars could be offloaded at four locations within the port by using two permanent and two portable end ramps. The potential location for the use of portable end ramps is on the terminal yard marginal tracks, near berth north C. The longest spur can accommodate about 21 to 25 railcars. Boxcars could be offloaded at the transit sheds, where 300 to 350 rail handling positions are available. Containers would be offloaded at the container handling facility.

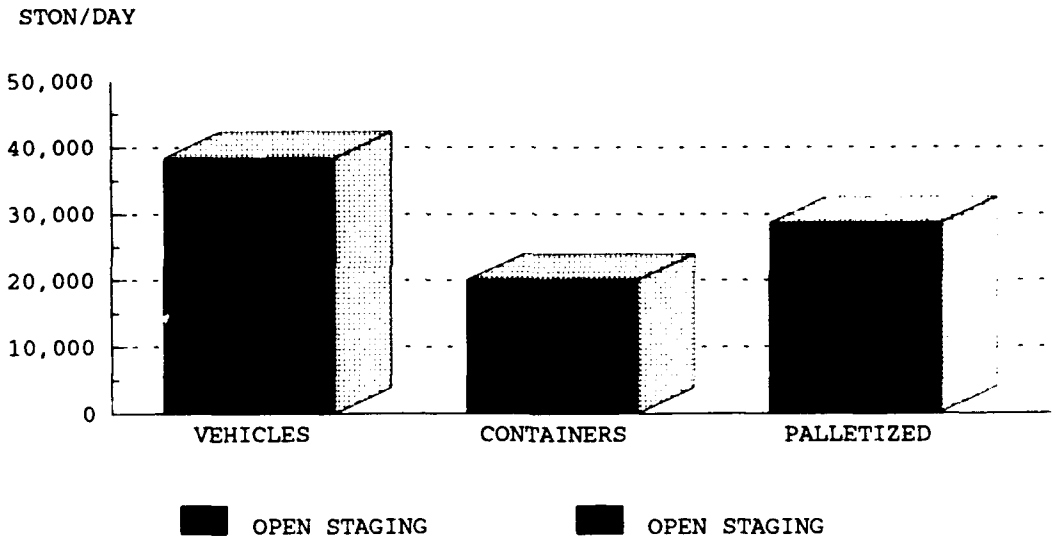
RAIL RECEPTION/HANDLING CAPABILITY



STAGING

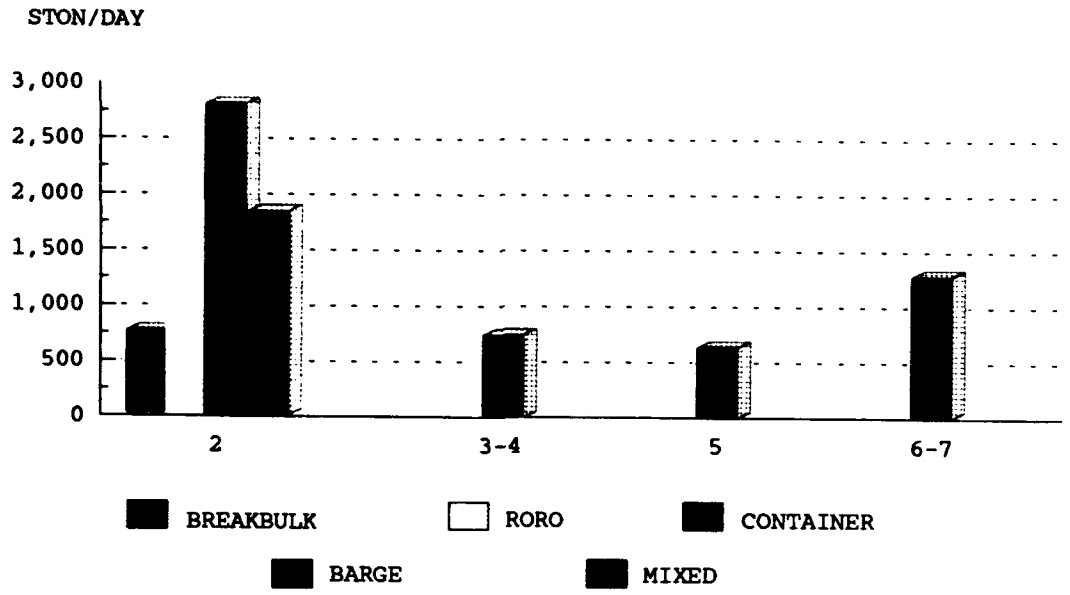
The port has about 37 acres of open storage for vehicles and/or containers. This staging area has a capability to store about 31,100 STON of breakbulk cargo and 7,230 STON of rolling stock (38,330 STON total). Container storage capability is about 20,000 STON. Also, about 1,774,000 square feet of covered storage provides protection for about 28,400 STON of palletized cargo.

STAGING CAPABILITY



SHIPPING

Figure 3 shows the throughput capability per berth in STON per day for breakbulk, RORO, container, and mixed vessels. These results were based on various factors, including MHE utilized, loading, operational, and berth utilization rates, as well as berth/ship compatibility.



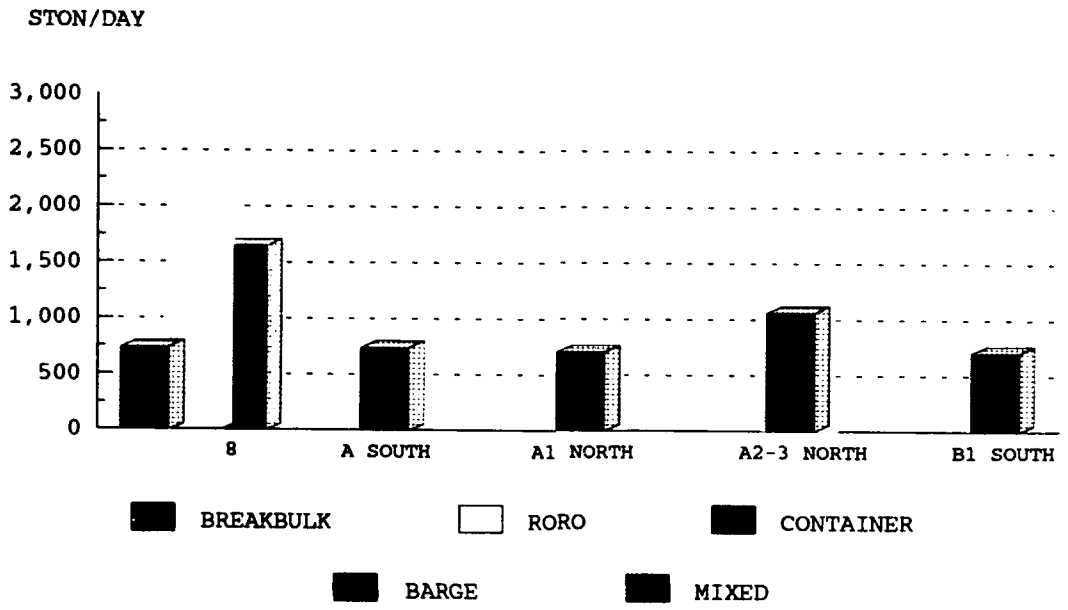
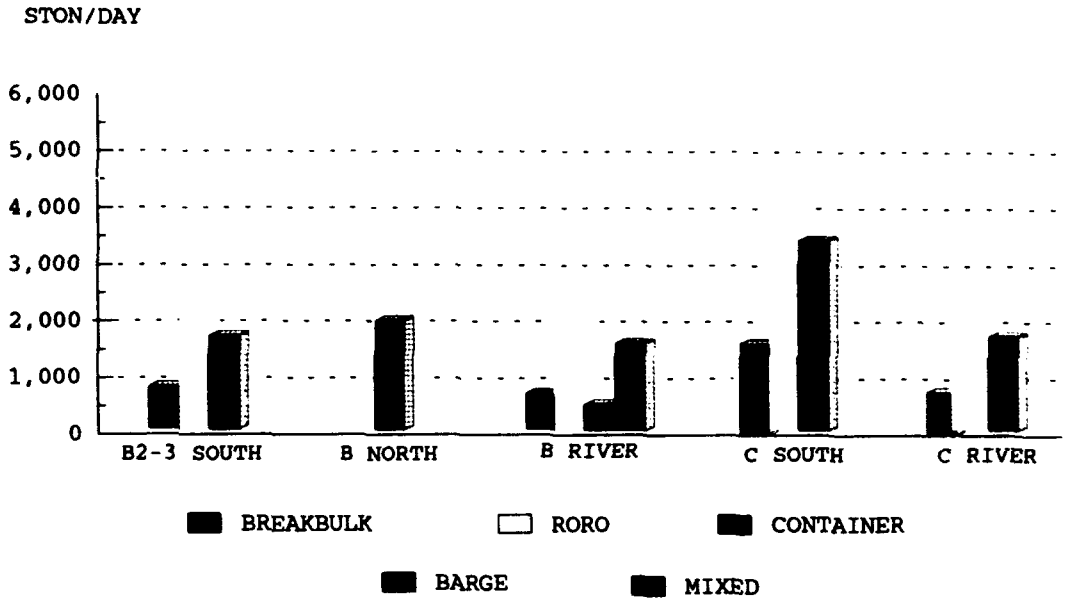


Figure 3. Berth throughput capability.



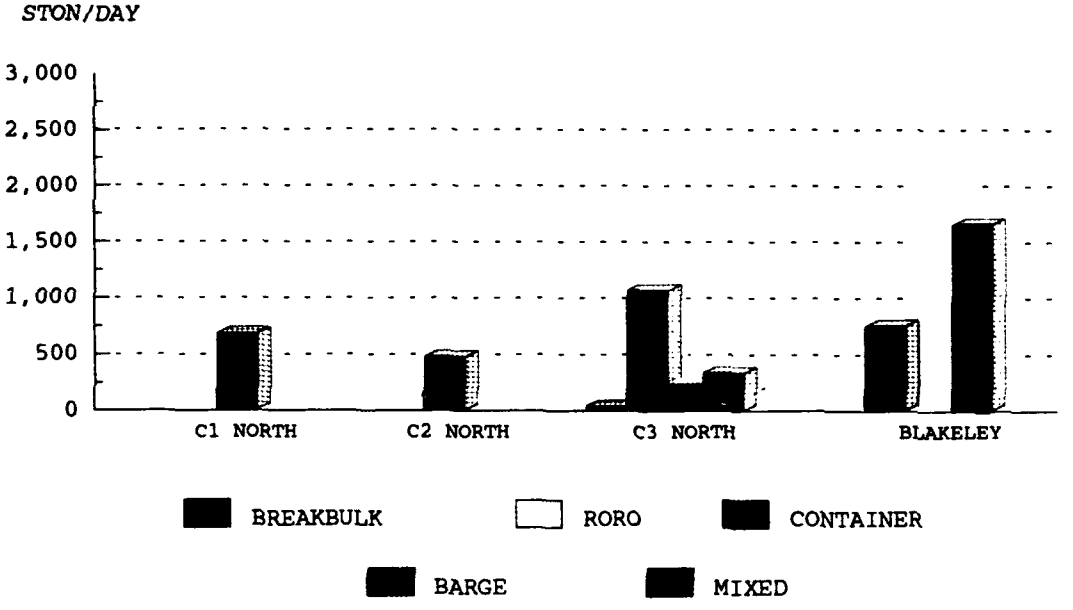


Figure 3. Continued.

The berthing capabilities for various vessel types is shown in table 1. The table indicates, for each type of ship, the number of vessels that can be accommodated at each berth. It also provides the limitations that can hinder shipping operations.

The type of ship preferred at each berth is based on methodology that compares the characteristics of the ship berth to a list of ideal factors required to support the different ship mixes. The evaluation takes into consideration the current physical characteristics and MHE available for a berth. This evaluation gives no considerations for enhancements, such as equipment.

Berth 2 provides the largest throughput capability for RORO, container, and barge operations. Overall, it is the most compatible berth for all ship types. B 2-3 south and C south also have good overall capability. C south could be used for breakbulk and RORO operations. C north (includes berths 1 through 3) provides a good alternative for container operations. The C north berth capability would increase with dredging of C 1 and C 2 north.

PREFERENCE BERTH SELECTION

Breakbulk	4	1	11	8	11	7
RORO	1	-	4	-	12	8
Container	1	5	6	9	-	-
Barge	1	4	8	14	14	2
NOTE: Berths marked with "-" are not recommended for these operations.						

Breakbulk	-	5	-	3
RORO	-	-	-	3
Container	-	7	-	3
Barge	10	10	6	2
NOTE: Berths marked with "-" are not recommended for these operations.				

PREFERENCE BERTH SELECTION

Breakbulk	5	16	1	8	10
RORO	-	11	1	5	9
Container	7	-	3	10	-
Barge	10	18	4	13	9

NOTE: Berths marked with "-" are not recommended for these operations.

Breakbulk	14	15	13
RORO	10	7	5
Container	12	11	2
Barge	16	16	6

NOTE: Berths marked with "-" are not recommended for these operations.

TABLE 1
SUMMARY OF STATE DOCKS BERTHING CAPABILITIES

Breakbulk									
C3-S-33a	1	1	1	2	1	1	a,c	2	a
C3-S-37c	1	1	1	2	1	1	a,c	1	a
C3-S-37d	1	1	1	2	1	1	a,c	1	a
C3-S-37a	1	1	1	2	1	1	(1)	1	a
C4-S-1a	1	1	(1)	1	1	1	a,c	1	a,c
C4-S-1qb and 1u	1	1	(1)	1	1	1	a,c	1	a,c
C4-S-58a	1	1	(1)	1	1	c	a,c	1	a,c
C4-S-65a	1	1	(1)	1	1	1	a,c	1	a,c
C4-S-66a	a	1	(1)	2	1	1	a,c	1	a,c
C4-S-69b	1	1	(1)	1	1	c	a,c	1	a,c
Seatrain									
GA and PR-class	1	1	(1)	1	1	1	(1)	1	(1)
Barge									
LASH C8-S-81b	a,f	1	a,c,f	a,f	c	c	a,c,f	1	a,c,f
LASH C9-S-81d	a	a	a,c	a	a,c	a,c	a,c	a	a,c
LASH lighter	6	7	3	8	4	4	3	7	3
SEABEE C8-S-82a	a	a	a,c	a	a,c	a,c	a,c	a	a,c
SEABEE barge	4	5	2	5	2	2	2	5	2
RORO									
Comet	d,i,j	d,o	d,i,j	d,o	i,j	d,o	c,d,o	d,o	d,i,j
C7-S-95a/Maine-class	a	b	(1)	b	b,c	c	a,b,c	b	a,c
Ponce-class	h	b,h	c,h	b,h	b,c,h	b,c,h	b,c,h	b,h	a,c,h
Great Land-class	h	b,h	c,h	b,h	b,c,h	b,c,h	b,c,h	b,h	a,c,h
Cygnus/Pilot-class	1	b	(1)	b	b,c	c	b,c	b	a,c
Meteor	d,i,j	d,o	c,d	d,o	i,j	d,o	a,c,d,o	d,o	a,c,d
AmEagle/Condor	i,j	b	(1)	b	b,c	c	a,b,c	b	a,c
MV Ambassador	d	d	c,d	d	1	d	c,d	d	c,d
FSS-class	a,c	b	(1)	b	b,c	c	a,b,c	b	a,c
Cape D-class	a	b	(1)	b	b,c	c	a,b,c	b	a,c
Cape H-class	a	a,b	a,c	a,b	b,c	c	a,b,c	a,b	a,c
Container									
C6-S-1w	1	1,e	(1),e	1,e	c,e	c,e	a,c,e	1,e	a,c,e
C7-S-68e	1	1,e	(1),e	1,e	c,e	c,e	a,c,e	1,e	a,c,e
C8-S-85c	a	1,e	(1),e	1,e	c,e	c,e	a,c,e	1,e	a,c,e
Combination									
C5-S-78a	a	1,e	(1),e	1,e	c,e	c,e	a,c,e	1,e	a,c,e
C5-S-37e	1	1,e	(1),e	1,e	c,e	c,e	a,c,e	1,e	a,c,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no-shored based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.
( ) indicates vessels assigned by analyst

TABLE 1 - CONTINUED

Breakbulk									
C3-S-33a	1	3	a	3	1	1	1	(1)	(1)
C3-S-37c	1	3	a	2	1	1	1	(1)	(1)
C3-S-37d	1	3	a	2	1	1	1	(1)	(1)
C3-S-37a	1	3	1	2	1	1	1	(1)	(1)
C4-S-1a	1	2	a	2	1	1	(1)	(1)	(1)
C4-S-1qb and 1u	1	2	a	2	1	1	(1)	(1)	(1)
C4-S-58a	1	2	a	2	1	1	(1)	(1)	(1)
C4-S-65a	1	2	a	2	1	1	(1)	(1)	(1)
C4-S-66a	1	2	a	2	1	1	1	(1)	(1)
C4-S-69b	1	2	a	2	1	1	(1)	(1)	(1)
Seatrain									
GA and PR-class	1	2	1	2	1	1	(1)	(1)	(1)
Barge									
LASH C8-S-81b	1	1	a,c,f	1	1	a,c,f	a,c,f	(1)	(1)
LASH C9-S-81d	a	1	a,c	a	a,c	a,c	a,c	a,c	a,c
LASH lighter	7	11	4	10	5	4	3	3	2
SEABEE C8-S-82a	a	a	a,c	a	a,c	a,c	a,c	a,c	a,c
SEABEE barge	5	8	3	7	4	3	2	2	2
RORO									
Comet	d,i,j	d,o	d,i,j	d,i,j	d,i,j	d,i,j	d,i,j	c,d	c,d
C7-S-95a/Maine-class	1	b	a,c	2	1	a,c	a,c	(1)	(1)
Ponce-class	h	b,h	c,h	b,h	h	c,h	c,h	c,h	c,h
Great Land-class	h	b,h	c,h	b,h	h	c,h	c,h	c,h	c,h
Cygnus/Pilot-class	1	b	1	2	1	1	(1)	(1)	(1)
Meteor	d,i,j	d,o	a,d	d,i,j	d,i,j	d,i,j	d,i,j	c,d	c,d
AmEagle/Condor	i,j	b	a	i,j	i,j	i,j	(1)	(1)	(1)
MV Ambassador	d	d	d	d	d	d	c,d	c,d	c,d
FSS-class	1,n	b	a,c	1,n	c	a,c	a,c	(1)	(1)
Cape D-class	i,j	b	a,c	i,j	i,j	c	(1)	(1)	(1)
Cape H-class	a	b	a,c	1	1	a,c	a,c	a,c	(1)
Container									
C6-S-1w	1,e	2,e	a,c,e	2,e	1,e	c,e	(1),e	(1),e	(1),e
C7-S-68e	1,e	2,e	a,c,e	2,e	1,e	c,e	(1),e	(1),e	(1),e
C8-S-85c	1,e	1,e	a,c,e	1,e	c,e	c,e	(1),e	(1),e	(1),e
Combination									
C5-S-78a	1,e	2,e	a,e	2,e	1,e	a,e	a,c,e	(1),e	(1),e
C5-S-37e	1,e	2,e	a,e	2,e	1,e	1,e	(1),e	(1),e	(1),e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
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Note: Ramp clearance and ramp angle based on maximum vessel draft.
( ) indicates vessels assigned by analyst

III. APPLICATION

GENERAL

We will evaluate the port's throughput capability for deploying a notional separate armored brigade primarily on FSS vessels. The *Planning Orders Digest*, issued by MARAD, does not include agreements for military use of the Port of Mobile. This study considers the facilities that would efficiently support military operations in lieu of planning orders. The port states that all of the port facilities (entire docks and open storage) could be made available to the military. The Military Traffic Management Command (MTMC) maintains a detachment at the Port of Mobile for coordinating military movements.

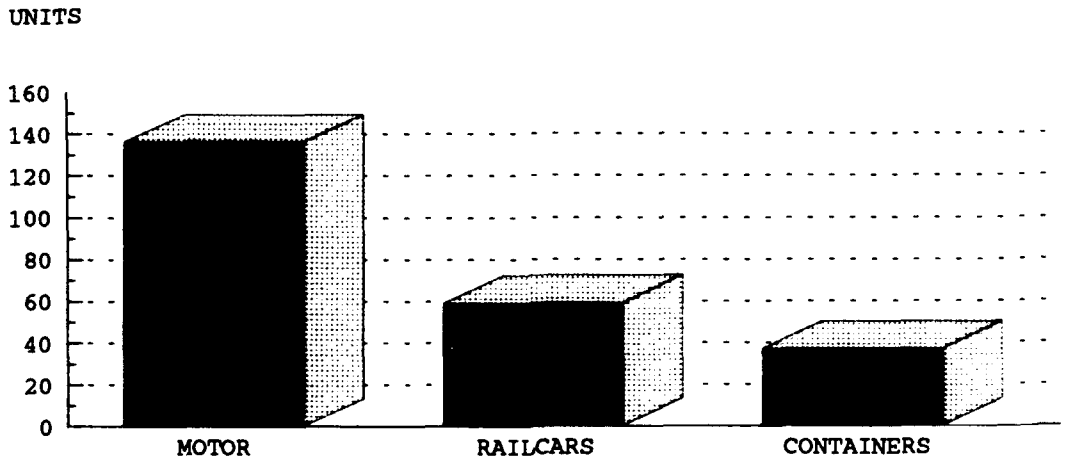
REQUIREMENTS

The likely requirement for the Port of Mobile is to deploy a notional separate armored brigade in 6 days. The division has to move about 1,755 vehicles and 220 containers. This movement to the port will require 353 (59 per day) railcars, using a convoy/rail option. Under this option, about 815 (136 per day) roadable vehicles would be driven and about 435 (73 per day) would be towed.

SEPARATE ARMORED BRIGADE DEPLOYMENT DATA

Total Equipment	
Volume	63,329 MTON
Weight	25,352 STON
Area	321,786 SQ FT
Vehicles	1,755
Containers	220

DAILY REQUIREMENTS



TERMINAL HANDLING

HIGHWAY

Vehicles would access the port through the main gate. With use of only the main gate, the access roads and gates processing subsystems could handle more than 1,200 vehicles per day.

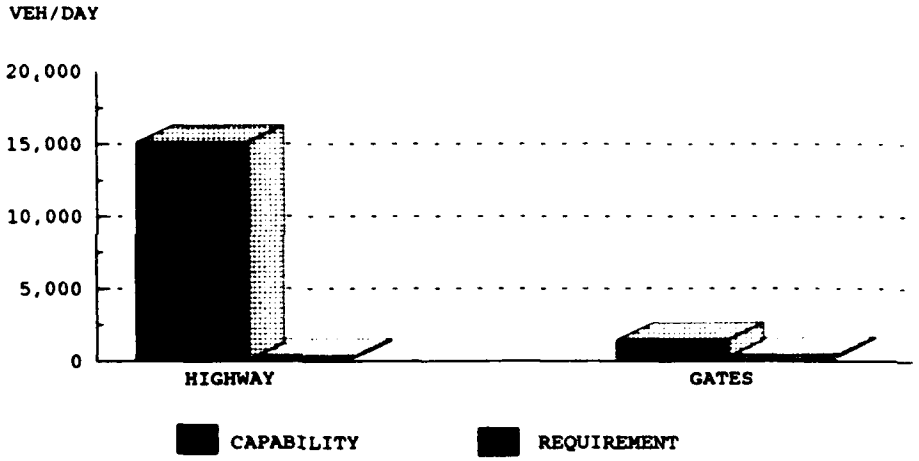
RAIL

The terminal yard within the port could easily handle more than 2,300 railcars per day. Also, the four ramp offloading locations could offload about 46 railcars every 5 hours, or more than 184 railcars per day.

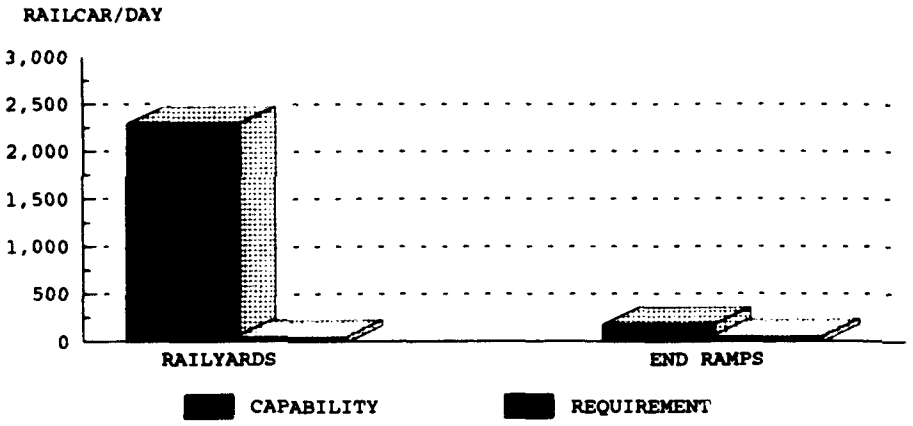
STAGING

The port has about 37 acres of open paved storage. We estimate that the Port of Mobile needs at least 16 acres (14 acres for vehicles and 2 acres for containers) of open staging to support the sustained loading of a one FSS vessel berth system.

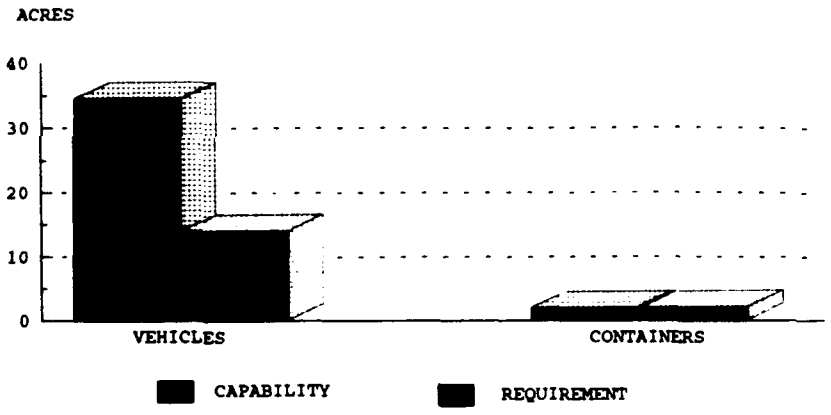
HIGHWAY INPROCESSING CAPABILITY



RAIL INPROCESSING/HANDLING CAPABILITY



OPEN STAGING CAPABILITY



SHIPPING

The number of ships needed to load this requirement depends on the ship mix selected. The best ship mix would require three FSS vessels and one Cape H RORO ship. Potential port facilities for berthing an FSS ship are berths 2, 5, river C, and north C 3. Although the Port of Mobile has four potential FSS berths, inadequate berth depth limits FSS operations to the north C 3 pier berth. The inadequate berth depth is attributable to heavy silting of the Mobile River and Port of Mobile. The Tennessee-Tombigbee inland waterway contributes heavily to the silting problem. The depth of berth river C is adequate for a Cape H RORO ship.

UNIT MOVEMENT REQUIREMENTS
ARMORED BRIGADE

Minimum Containerization				
All FSS*	2.67	0.64		
FSS and Cape H	2.23	1.00		
All Breakbulk			12.63	
Maximum Containerization				
FSS and Container	2.65			0.67
FSS, Cape H, and Container	1.56	1.00		0.67
Breakbulk and Container			9.87	0.67

*Only 8 FSSs are available. Unit shipping requirements exceed the capacity of these 8 vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

Legend:

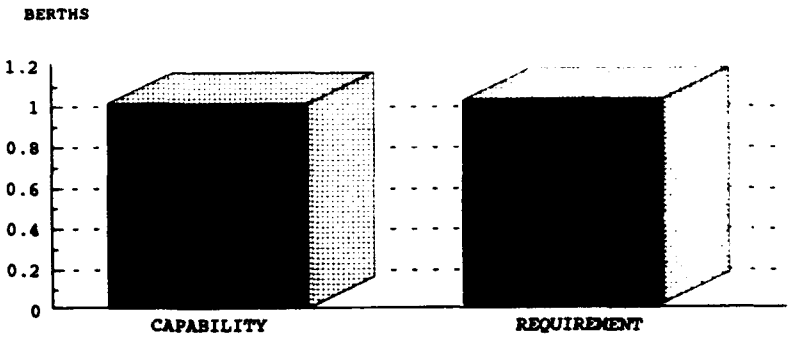
RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, 91.

Based on 2 days to load a ship, a separate armored brigade can outload within the 6-day requirement. The Port of Mobile can enhance its capability to outload military units by maintaining adequate depths at berths 2, 5, and river C (37 feet for an FSS ship).

FSS SHIPPING CAPABILITY



SUMMARY

The berthing restrictions of the FSS vessels limit the Port of Mobile to one FSS vessel support system. This will still meet the requirement for supporting the deployment of one separate armored brigade. However, the Port of Mobile can enhance its outloading capability by maintaining a berth depth of at least 37 feet in selected berths to support FSS vessels.

The shipping subsystem is the constraining factor in the throughput capability for the Port of Mobile.

Currently, berth 2 is the best all-around berth for outloading.

RECOMMENDATIONS

1. Use berth north C for an FSS and river C for a RORO in deployment operations, provided the port can maintain berth depths of 37 feet for FSS vessels and 36 feet for a Cape H RORO ship. Berth 2 could serve as an alternate; however, the ship berth depth must increase to 37 feet to support FSS vessels at maximum draft.

2. The Port of Mobile maintain a ship berth depth of at least 37 feet at berths 2, 5, river C, and north C.

PORT OF NEW ORLEANS

NEW ORLEANS, LOUISIANA

I. GENERAL DATA

TRANSPORTATION ACCESS

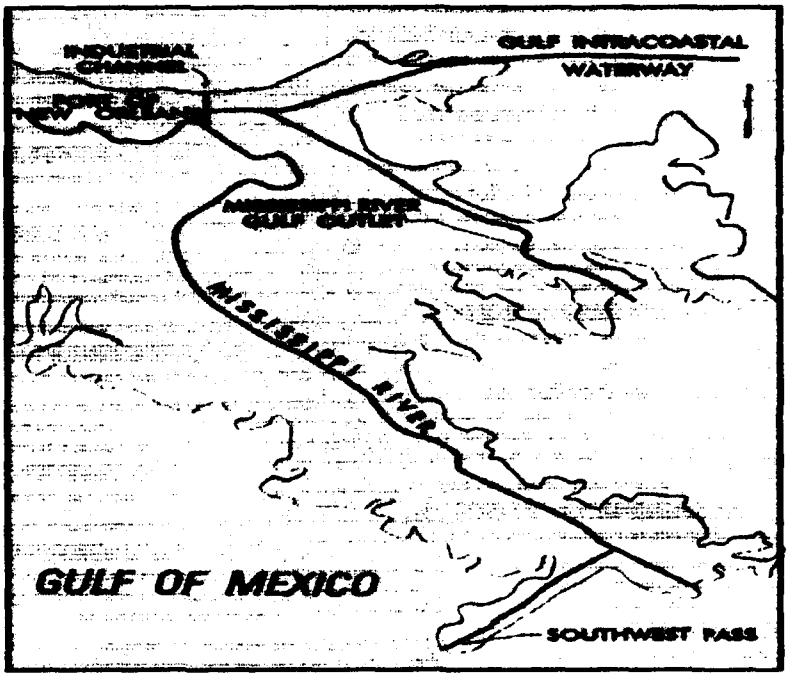
WATER

All together, the New Orleans Port Authority (Dock Board) controls about 13 miles of wharves that support various cargo types. This report analyzes the three terminals that are best for military operations. They are Henry Clay/Nashville, France, and Jourdan. The Henry Clay/Nashville (HC/N) Terminal is on the east bank of the Mississippi River. The France and Jourdan Terminals are on the Industrial Canal.

The Port of New Orleans, Louisiana, is in the southwestern part of the State. The facilities analyzed in this report are about 100 miles upstream (via the Mississippi River) from open water of the Gulf of Mexico.

Entrance to the HC/N Terminal is via the Southwest Pass and the Mississippi River. This route from the Gulf of Mexico is at least 40 feet deep and 500 feet wide. A 1,600-foot-wide by 36-foot-deep MLW turning basin is at the confluence of the Mississippi River Gulf Outlet and the Industrial Canal.

Access to the France and Jourdan Terminals from the Gulf of Mexico is by way of the Mississippi River Gulf Outlet, to the Industrial Canal. This route is at least 36 feet deep and 500 feet wide. In spite of their proximity, vessels cannot access the France and Jourdan Terminals from the Mississippi River. This is due to narrow locks between the Industrial Canal and the river. Ships may turn in the Mississippi River near the HC/N Terminal. In this area, the channel is 35 feet deep MLW and 1,500 feet wide. Ships with a draft greater than 35 feet must turn about 14 miles downstream, where the channel is 40 feet deep by 1,000 feet wide.



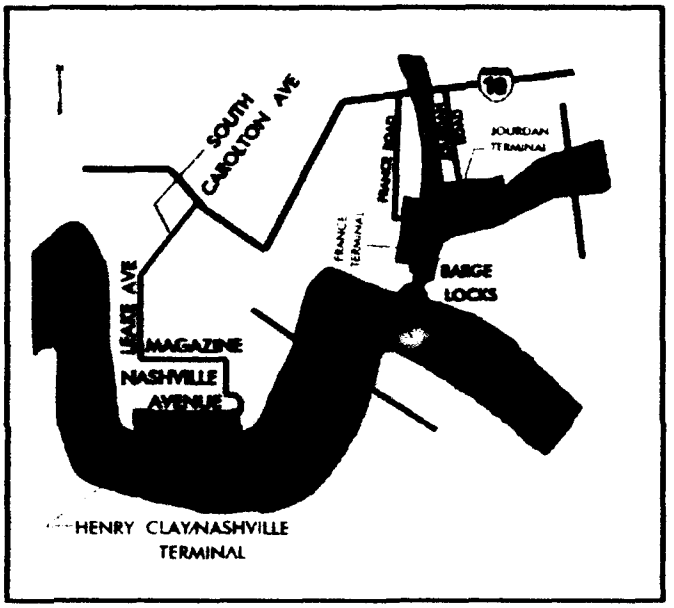
Water Access

Only three bridges cross downstream of the facilities chosen for analysis. The Greater New Orleans Twin Bridges cross the Mississippi River about 5-1/2 miles below the HC/N Terminal. These bridges each have a horizontal clearance of 750 feet and a vertical clearance of 149 feet mean high water (MHW). The Paris Road Bridge is about 5 miles downstream of the France and Jourdan Terminals and crosses the Mississippi River Gulf Outlet. This bridge has a horizontal clearance of 500 feet and a vertical clearance of 137 feet MHW.

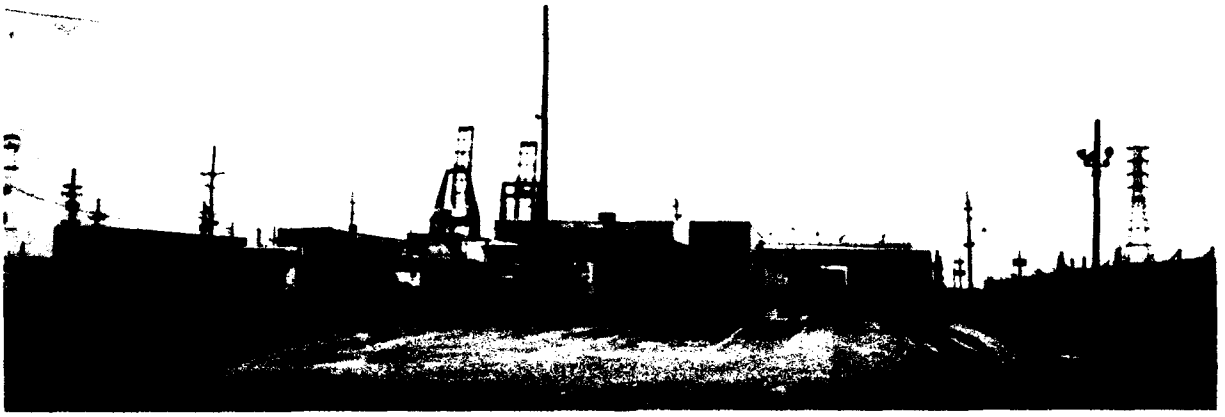
Upstream Terminal	HC/N	Jourdan & France
Height above MHW	149	137
Width of Channel	750	500

HIGHWAY

An extensive network of highways serves the Port of New Orleans. Interstate Route 10 provides access from the east or west.



Highway Access

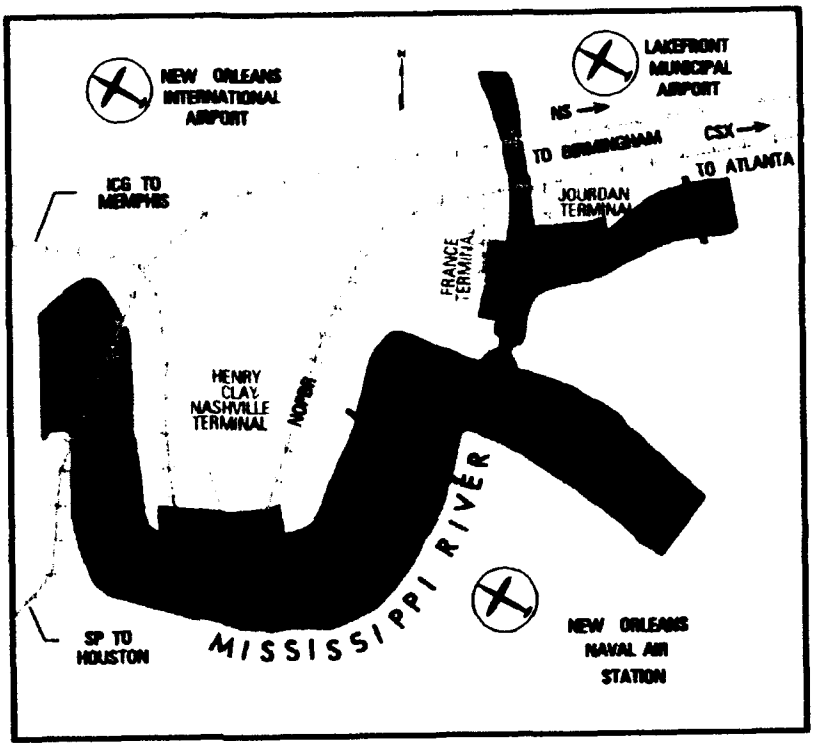


Gate at France Terminal

RAIL

The New Orleans Public Belt Railroad (NOPBR) acts as a switching carrier. The NOPBR serves all public wharves on the Mississippi River and the Industrial Canal.

Within a 12-mile radius of the port are six regional railyards, ranging in capacity from 900 to 2,000 railcars. The terminal's own rail spurs and sidings provide additional railcar storage.



Rail and Airport Access

AIR

Three airports are within a 10-mile radius of the port district of New Orleans. These airports are two commercial fields and one military.

AIRPORTS NEAR THE PORT OF NEW ORLEANS

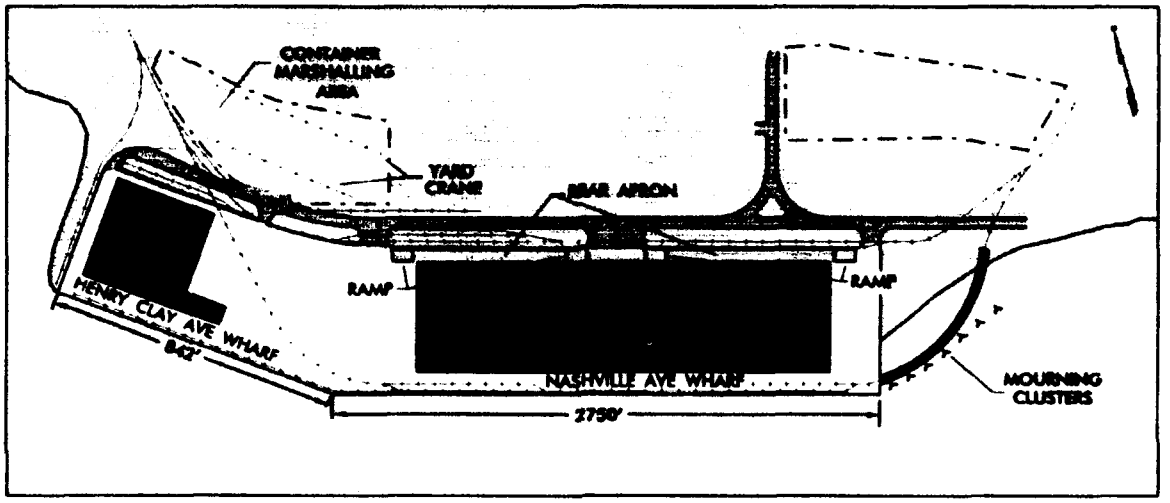
[redacted]			
Main Runway:			
Length	9,200 ft	6,700 ft	8,000 ft
Width	150 ft	150 ft	200 ft

PORT FACILITIES

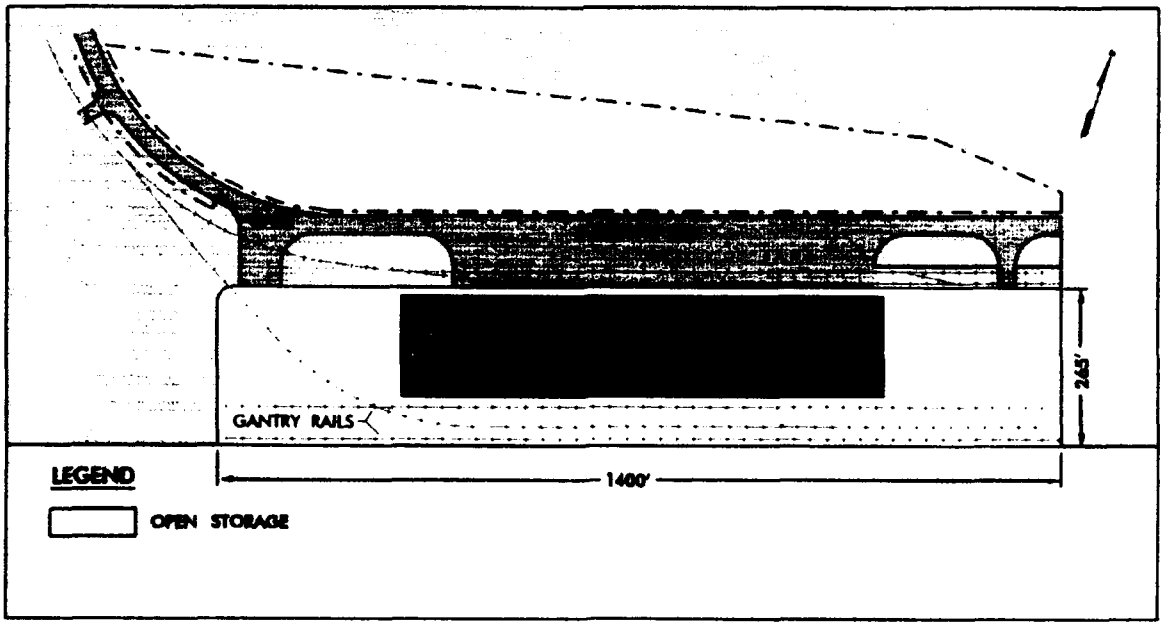
BERTHING

The France Terminal is equipped to handle containers, while HC/N and Jourdan are multicargo terminals. Pier construction at the terminals is generally concrete-filled steel piles, fronting a sheet-steel bulkhead. Fendering is generally timber. All three terminals are lighted for night operations.

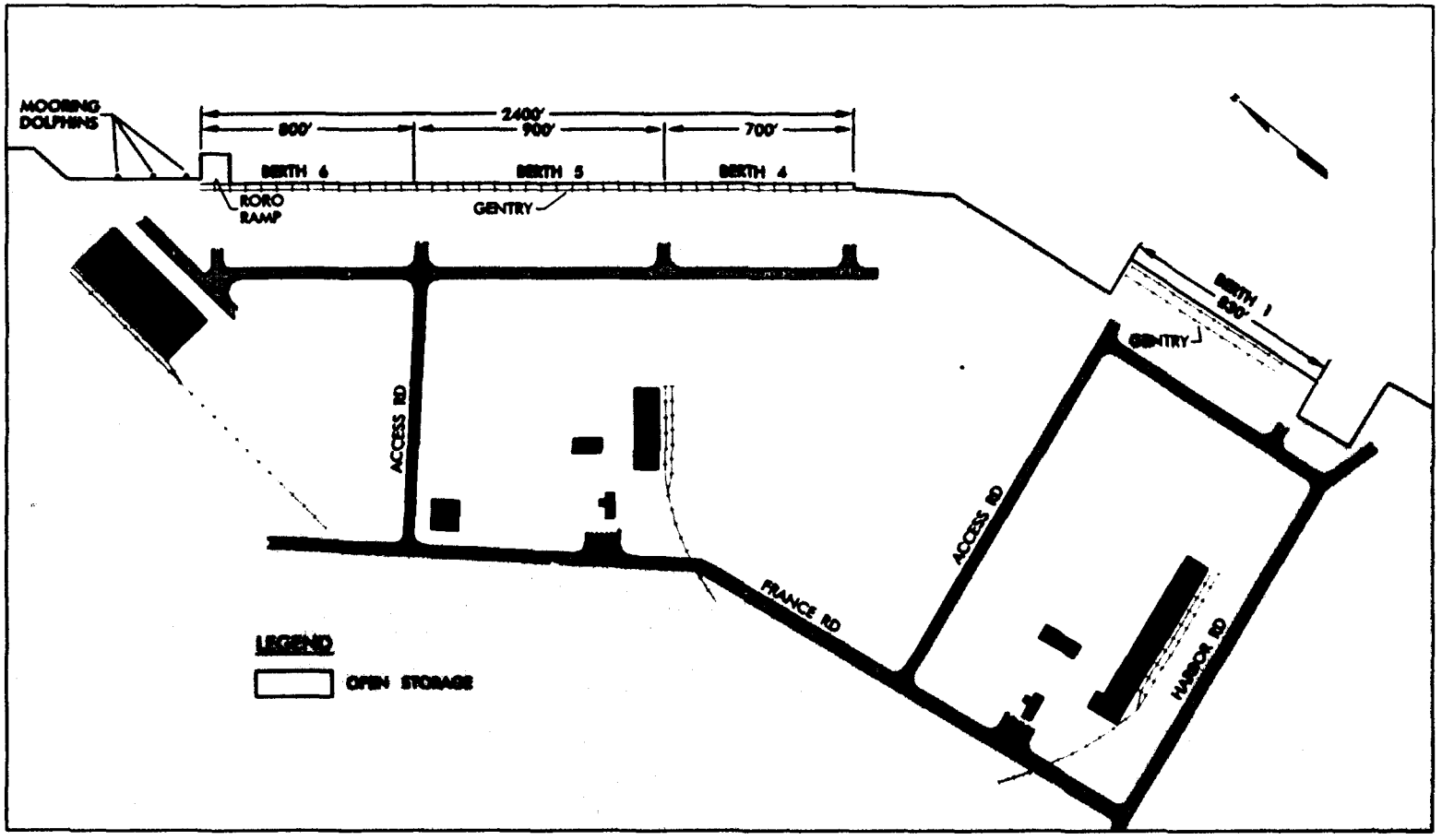
Below are land-use maps of the three terminals. Figures 1 through 3 are aerial views of the terminals and include tables that identify berth characteristics.



Henry Clay/Nashville Terminal Land-Use Map



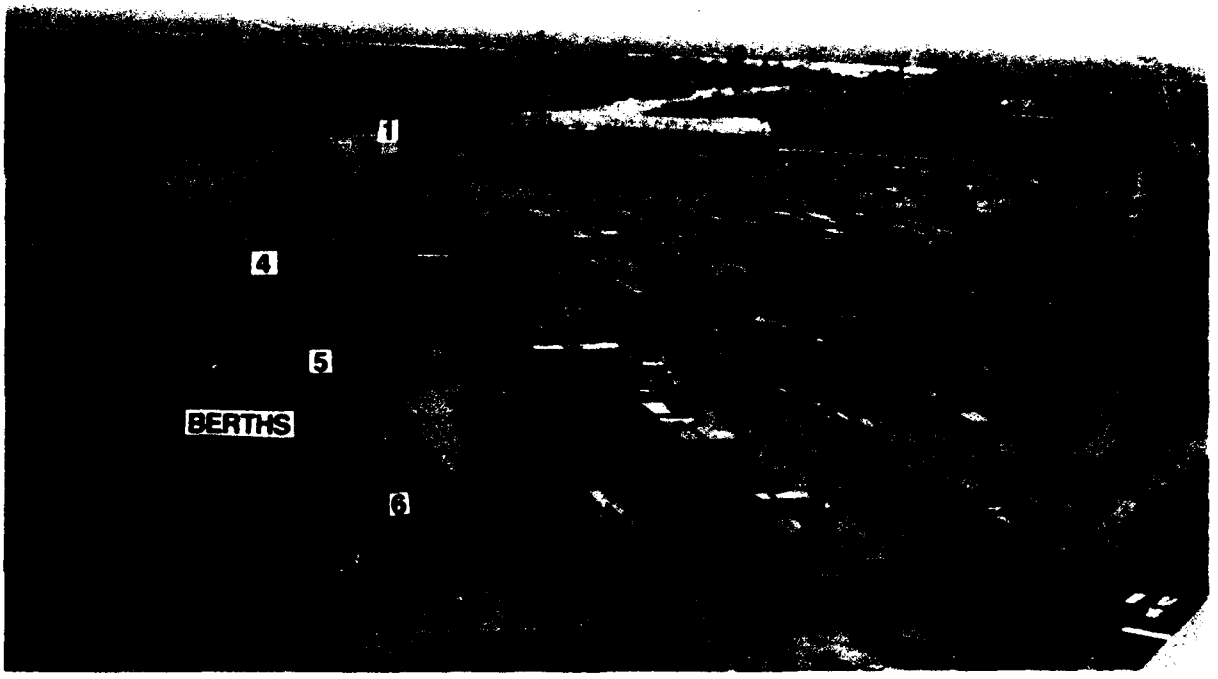
Jourdan Terminal Land-Use Map



France Terminal Land-Use Map

BERTH CHARACTERISTICS OF FRANCE TERMINAL

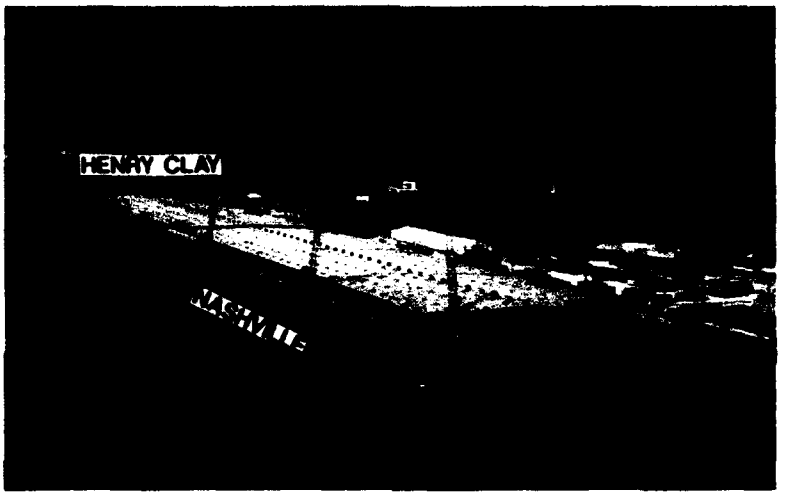
Length (ft)	830	2,400
Depth alongside at MLW (ft)	36	36
Deck strength (psf)	750	850
Apron width (ft)	Open	Open
Number of container cranes	2	3
Number of wharf cranes	0	0
Apron lighting	Yes	Yes
Straight-stern RORO facilities	No	No
Apron length served by rail (ft)	0	0



France Terminal (Southward View)

BERTH CHARACTERISTICS OF HENRY/CLAY NASHVILLE TERMINAL

Length (ft)	842	2,759
Depth alongside at MLW (ft)	35	35
Deck strength (psf)	850	850
Apron width (ft)	Open	62
Apron height above MLW (ft)	22	22
Number of container cranes	0	0
Apron lighting	Yes	Yes
Straight-stern RORO facilities	No	No
Apron length served by rail (ft)	842	2,759



Henry Clay/Nashville Terminal (Westward View)

BERTH CHARACTERISTICS OF JOURDAN TERMINAL

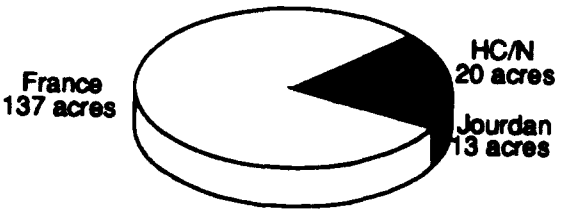
Length (ft)	1,400
Depth alongside at MLW (ft)	36
Deck strength (psf)	850
Apron width (ft)	70
Apron height above MLW (ft)	10
Number of container cranes	1
Apron lighting	Yes
Straight-stern RORO facilities	Yes
Apron length served by rail (ft)	1,400

Jourdan Terminal (Northward View)

STAGING

Open Staging

The three terminals in this report have about 170 acres of open staging. All the open staging is paved. Most of this staging is at the France Terminal.



Helicopters can land in the open areas of the France Terminal, or inland of the Jourdan Terminal transit shed. The HC/N Terminal is too congested for helicopters to land.

Open Staging at France Terminal Berth 1

Covered Staging

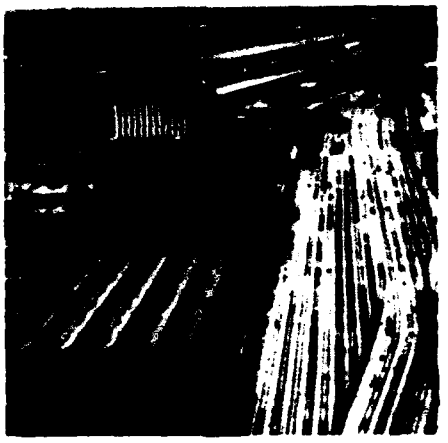
Six sheds provide about a million square feet of covered storage. The Henry Clay/Nashville Terminal has most of it.

Covered Staging at Henry Clay Berth

RAIL

Rail trackage links the railyards to the port's storage yards, transit sheds, and apron tracks. Apron tracks are at the HC/N and Jourdan Terminals.

Railyards on port property can hold about 1,800 railcars.



Port-Owned Railyard at Napoleon Avenue

HIGHWAY

The France Terminal has two truck scales - one at berth 1 and one at berth 5. HC/N and Jourdan Terminals have none.

UNLOADING/LOADING POSITIONS

Ramps

The port has no permanent rail or truck end ramps; however, it has numerous locations available for the construction of temporary ramps. Two portable end ramps are available. These ramps could support the loading of flatcars or flatbed trailers.

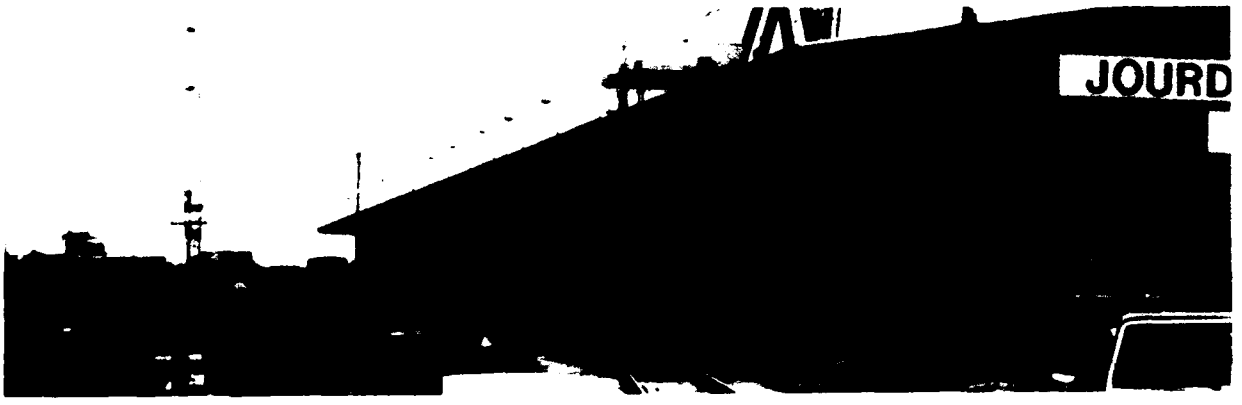
HCN	32
Jourdan	10
France	60

Docks

All sheds have truck handling positions. Tracks and fences limit truck access to only one side, on some sheds.

All three terminals have two parallel railcar-level tracks along the inland side of their sheds. A total of 154 boxcars can be handled if placed on both tracks.

HCN	44
Jourdan	15
France	18



Boxcar docks at Jourdan Terminal

MARSHALING AREAS

Onsite

The port has no marshaling areas. All open area within the port is required for staging military or commercial cargo.

Offsite

The New Orleans area is highly developed. It has no areas that are readily available for marshaling.

CONTAINER CRANES

Jourdan	1*	30
France		
1	2*	30
4 - 6	3	40

*These cranes are not owned by the port authority.

MATERIALS HANDLING EQUIPMENT

The Jourdan Terminal has a 30-ton container crane. The France Terminal has 5 container cranes.

Other MHE is available from local stevedore and rental companies.

The HC/N Terminal has a transtainer for chassis handling only.

RENTAL MHE

Mobile Cranes	1	10
	2	15*
	1	25
	1	35
	1	40
Barge Cranes	5	15
	1	35
	3	40
	1	60
	1	75
	4	80
	3	135
Forklifts	over 100	various

*One of these is owned by the Port Authority

Container Crane

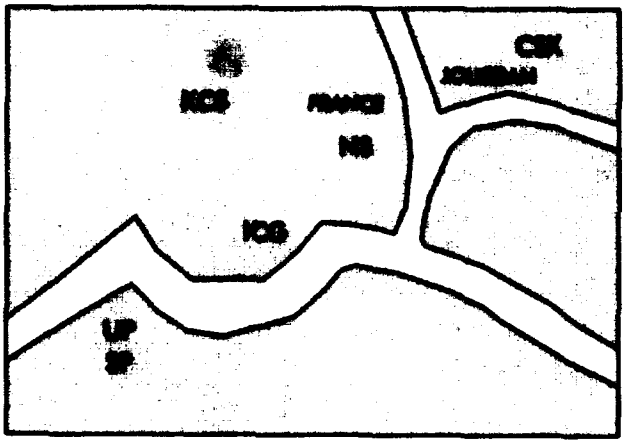
Container Handler

INTERMODAL FACILITIES

Four railroad companies operate intermodal railyards in the New Orleans area.

INTERMODAL RAILYARDS

CSX	507	275
ICG	228	100
KSC	450	125
NS	225	75
SP	340	275
UP	210	(later)



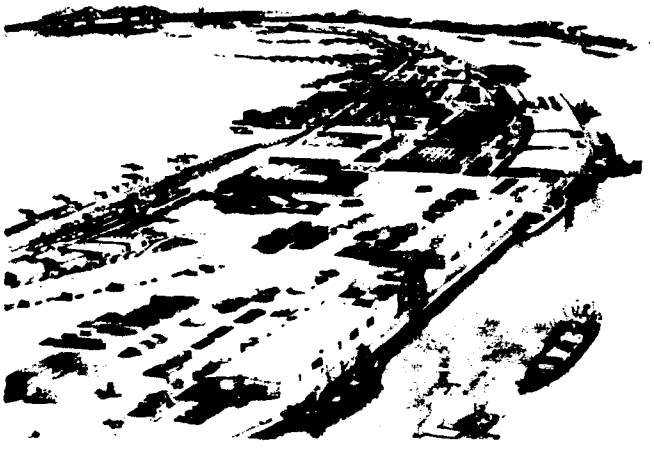
Intermodal Railyards

FUTURE DEVELOPMENT

The Port of New Orleans has already broken ground for an extensive construction and upgrading project. The construction area of greatest interest for military operations is along the Mississippi River terminals. Smaller projects will improve the France and Jourdan Road Terminals, on the Industrial Canal.

MISSISSIPPI RIVER TERMINALS

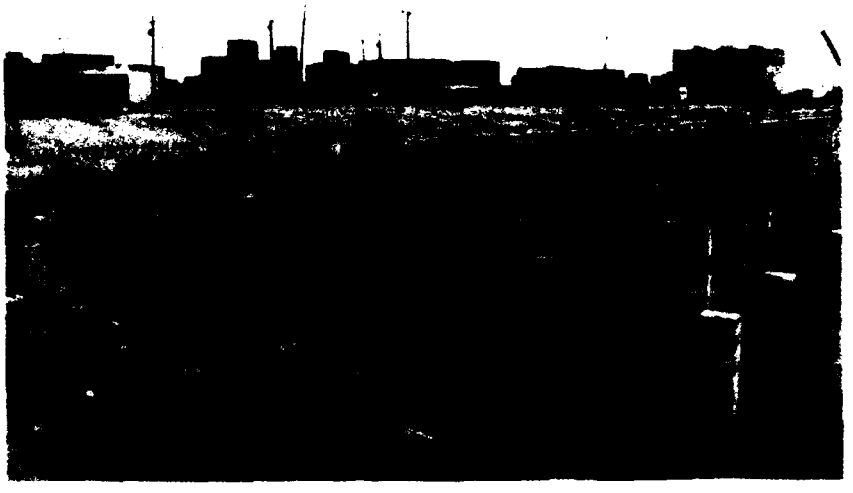
Part of the construction and improvement program for the Mississippi River Terminals is to build wharfage from the existing Nashville Avenue Terminal eastward to the Napoleon Avenue Terminal. The New Orleans Port Authority expects Nashville B to be operational in 1996. This will add 3,170 feet of wharfage to the port. Less than 800 feet will front a 150,000-square-foot transit shed and narrow apron. About 13 acres of open staging will be on the open apron and about 37 acres of marshaling will be further inland. Current plans call for container crane rails, but no container crane at this time.



Future Nashville Avenue Terminal

The port also has plans to improve the rail assets at this wharfage. Two gantry cranes will operate inland of the 37-acre marshaling area for intermodal operations. Two tracks will run between the container crane rails to support direct transfer. Tracks will also run to the rear of the transit shed.

Current plans also call for wharfage construction and reinforcement further downstream of the Nashville B development. The wharfage for the Napoleon Avenue Terminal, downstream of the Nashville B construction, will be reinforced from 350 to 800 pounds per square foot rating. Still further downstream, a 200-foot-wide apron will extend 767 feet along the water from the east end of the Napoleon wharves. About 400 feet of this apron will front the existing Milan Street transit shed.



Nashville B Development

These wharfage additions and improvements will provide about 9,500 feet of continuous wharfage. About 4,500 feet of this wharfage will have at least 200 feet of apron width. Water depth along the wharf is unknown, but is expected to be at least 35 feet MLW.

FRANCE ROAD TERMINAL

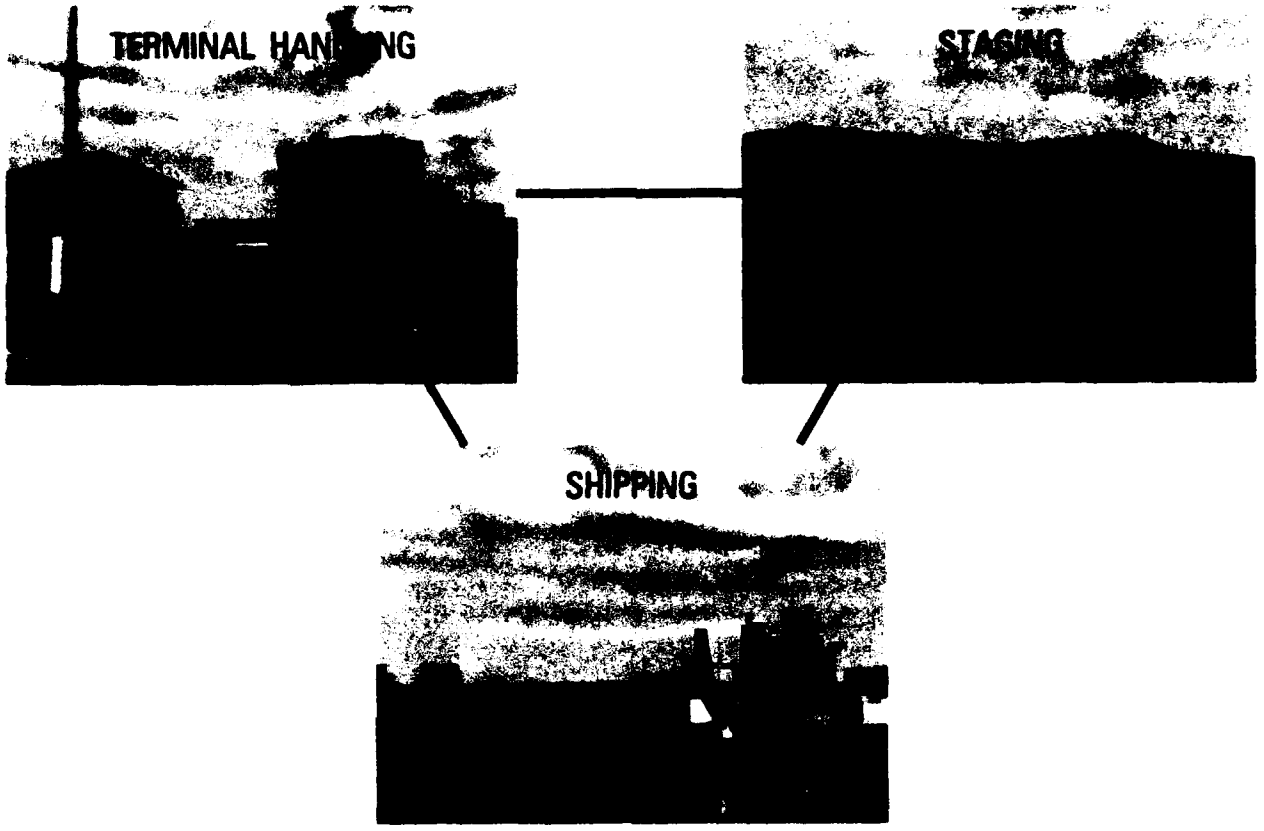
Most of the projects for the France Road Terminal are still in the planning stage, or are merely reinforcements and maintenance of existing facilities, or are improvements in the flood control network protecting the city. One exception is the addition of paved marshaling areas totaling 8 acres. These areas will support container operations at berths 5 and 6. This pavement will be operational in early 1996.

Future France Terminal

II. THROUGHPUT ANALYSIS

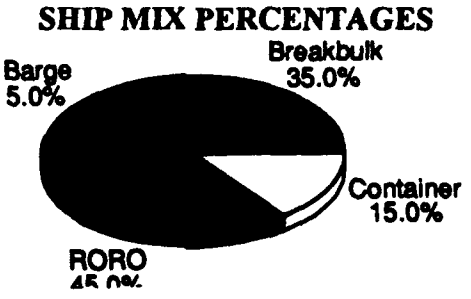
GENERAL

This section evaluates the throughput capability of the Port of New Orleans using the port operational performance simulator (POPS) computer model. The model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/ handling - in short tons (STON) per day.



Terminal Throughput Subsystems

The analysis assumes that 80 percent of the port facilities will support military deployments. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.



RECEPTION/HANDLING

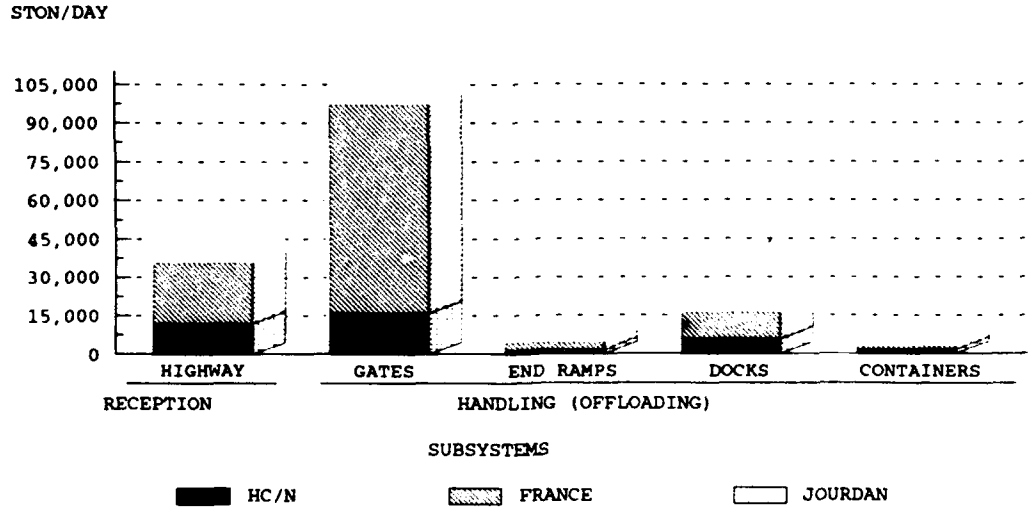
HIGHWAY

Interstate 10 provides access to the various terminals at the Port of New Orleans. Access to the HC/N Terminal is via Nashville Avenue. Access to the France Terminal is via France Road. Access to the Jourdan Terminal is via Jourdan Road. Five gates allow access into these three terminals. Three of the gates access the France Terminal. The road network in and out of terminals, including the gate processing of vehicles, could handle more than 42,000 STON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to the staging areas. Vehicles on commercial or military flatbed trailers without integral ramps will offload at portable ramps. The port has no permanent truck end ramps at any of these terminals. Our analysis assumes one portable ramp inland of the HC/N terminal, one portable ramp inland of the Jourdan Terminal, and two portable ramps inland of the France Terminal. These four ramps could offload more than 6,400 STON from flatbed trailers per day.

Supplies in van semitrailers will proceed to the 102 van-handling positions. These docks can offload about 18,000 STON of van semitrailer-shipped material per day. Containers on chassis will move to the staging areas to be offloaded by cranes. The transtainer at the HC/N Terminal, cranes at the France Terminal, and a container handler at the Jourdan Terminal could offload about 4,500 STON of cargo from their chassis per day.

HIGHWAY RECEPTION/HANDLING CAPABILITY



RAIL

Rail reception at all three terminals is very good, with four major railroad companies accessing the New Orleans area. Port-owned railyards at or near the three terminals can hold about 1,800 railcars.

RAIL DELIVERY

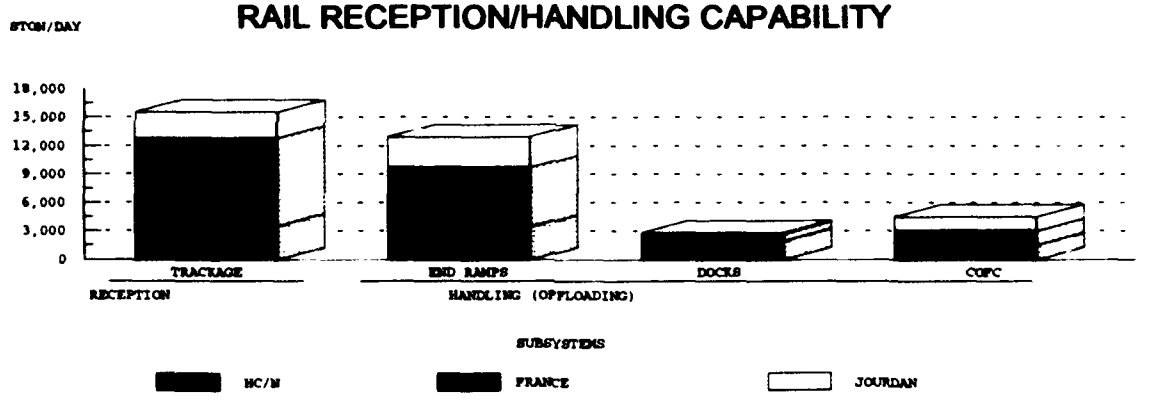
HC/N	50	2
France	80	3
Jourdan	75	1

Vehicles on flatcars could be offloaded using four portable end ramps. Boxcars could be offloaded at the transit sheds, where about 102 boxcar handling positions are available. Containers could be offloaded with a container handler at each terminal.

PORTABLE END RAMP LOCATIONS AND LENGTHS

HC/N behind shed	20
France berth 6 CFS	5
France railyard	10
Jourdan behind shed	9

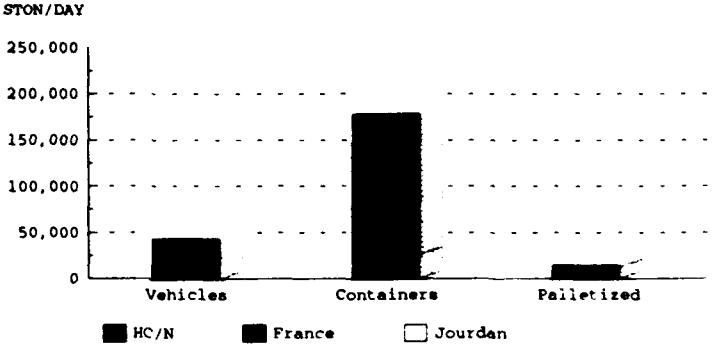
RAIL RECEPTION/HANDLING CAPABILITY



STAGING

The three terminals have about 175 acres of open staging. Most of it is at the France terminal. They also have more than a million square feet of covered storage. Our analysis does not include the HC/N Terminal for RORO staging. The apron height and water depth are insufficient for any RORO ship to berth.

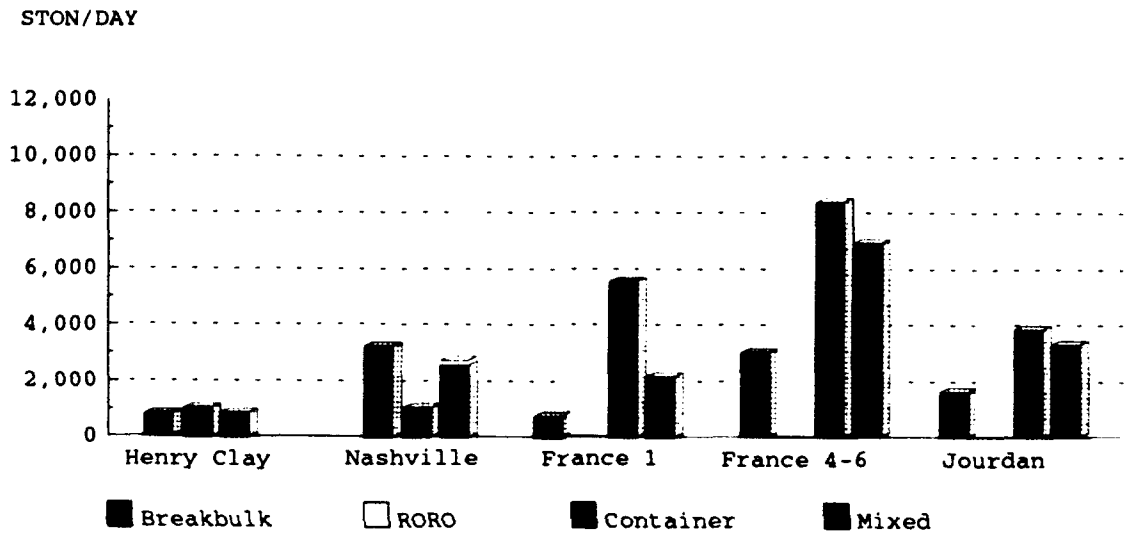
STAGING CAPABILITY



SHIPPING

Throughputs shown below for each terminal are based on various factors, including MHE used, loading, operational, and berth usage rates, as well as berth/ship compatibility.

BERTH THROUGHPUT CAPABILITY



The berth/ship compatibility for various vessel types are shown in tables 1 through 3. The tables shows, for each type of ship, the number of vessels that can be accommodated at each berth. They also provide the limitations that can hinder shipping operations.

The type of ship preferred at each berth is based on the methodology described in the appendix. The evaluation is based on a snapshot view of the current physical characteristics of the berths and the MHE available. The evaluation gives no considerations for enhancements, such as equipment.

The France Terminal berths provide the largest throughput capacity for container and RORO vessels. Berth 4-6 is the best berth, because of its length, cranes, and RORO ramp.

PREFERENCE BERTH SELECTION

Henry Clay/Nashville			
HC	1	-	-
N	1	-	-
France			
1	5	3	2
4 - 6	4	2	1
Jourdan			
	3	1	3

TABLE 1

SUMMARY OF BERTHING CAPABILITIES OF HENRY CLAY/NASHVILLE TERMINAL

Breakbulk	1	5
C3-S-33a	1	5
C3-S-37c	1	5
C3-S-37d	1	5
C3-S-38a	1	4
C4-S-1a	1	4
C4-S-1qb and 1u	1	4
C4-S-58a	1	4
C4-S-65a	1	4
C4-S-66a	1	4
C4-S-69b	1	4
Seatrain		
GA and PR-class	1	4
Barge		
LASH C8-S-81b	1	3
LASH C9-S-81d	a,c	a
LASH lighter	6	19
SEABEE C8--S-82a	a,c	a
SEABEE barge	4	13
RORO		
Comet	d,i,j	d,o
C7-S-95a/Maine-class	i,j	i,j
Ponce-class	h	b,h
Great Land-class	h	b,h
Cygnus/Pilot-class	i,j	i,j
Meteor	d,i,j	d,o
AmEagle/Condor	i,j	i,j
MV Ambassador	d	d
FSS-class	c	i,j,n
Cape D-class	i,j	i,j
Cape H-class	a	a
Container		
C6-S-1w	1,e	4,e
C7-S-68e	1,e	3,e
C8-S-85c	1,e	3,e
Combination		
C5-S-78a	1,e	4,e
C5-S-37e	1,e	4,e

a = maximum vessel draft limited to berth depth	h = no shore-based ramps available
b = inadequate apron width	i = insufficient ramp clearance at low tide
c = inadequate berth length	j = insufficient ramp clearance at high tide
d = no straight stern-ramp facilities	k = excessive ramp angle at low tide
e = no container-handling equipment	m = excessive ramp angle at high tide
f = inadequate berth depth, adequate anchorage depth	n = parallel ramp operation only
g = inadequate channel depth	o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

TABLE 2

SUMMARY OF BERTHING CAPABILITIES OF FRANCE TERMINAL

Breakbulk	1	4
C3-S-33a	1	4
C3-S-37c	1	4
C3-S-37d	1	4
C3-S-38a	1	4
C4-S-1a	1	4
C4-S-1qb and 1u	1	4
C4-S-58a	1	4
C4-S-65a	1	4
C4-S-66a	1	4
C4-S-69b	1	3
Seatrain		
GA and PR-class	1	4
Barge		
LASH C8-S-81b	1	2
LASH C9-S-81d	a,c,g	a,g
LASH lighter	5	17
SEABEE C8--S-82a	a,c,g	a,g
SEABEE barge	4	12
RORO		
Comet	d,i,j	i,j
C7-S-95a/Maine-class	1	3
Ponce-class	h	h
Great Land-class	h	h
Cygnus/Pilot-class	1	3
Meteor	d,i,j	i,j
AmEagle/Condor	i,j	i,j
MV Ambassador	d	4,m
PSS-class	c	2
Cape D-class	i,j	i,j
Cape H-class	1	3
Container		
C6-S-1w	1	3
C7-S-68c	1	3
C8-S-85c	1	2
Combination		
C5-S-78a	1	3
C5-S-37e	1	3

a = maximum vessel draft limited to berth depth	h = no shore-based ramps available
b = inadequate apron width	i = insufficient ramp clearance at low tide
c = inadequate berth length	j = insufficient ramp clearance at high tide
d = no straight stern-ramp facilities	k = excessive ramp angle at low tide
e = no container-handling equipment	m = excessive ramp angle at high tide
f = inadequate berth depth, adequate anchorage depth	n = parallel ramp operation only
g = inadequate channel depth	o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

TABLE 3

SUMMARY OF BERTHING CAPABILITIES OF JOURDAN TERMINAL

Breakbulk	
C3-S-33a	2
C3-S-37c	2
C3-S-37d	2
C3-S-38a	2
C4-S-1a	2
C4-S-1qb and 1u	2
C4-S-58a	2
C4-S-65a	2
C4-S-66a	2
C4-S-69b	2
Seatrain	
GA and PR-class	2
Barge	
LASH C8-S-81b	1
LASH C9-S-81d	a,g
LASH lighter	10
SEABEE C8--S-82a	a,g
SEABEE barge	7
RORO	
Comet	i,j
C7-S-95a/Maine-class	1
Ponce-class	b,h
Great Land-class	b,h
Cygnus/Pilot-class	2
Meteor	i,j
AmEagle/Condor	i,j
MV Ambassador	2,m
FSS-class	1,n
Cape D-class	i,j
Cape H-class	1
Container	
C6-S-1w	2
C7-S-68c	1
C8-S-85c	1
Combination	
C5-S-78a	2
C5-S-37c	2

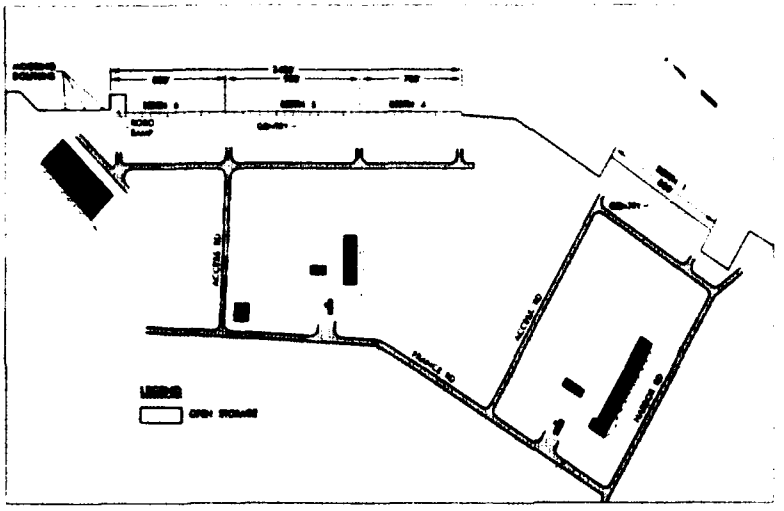
a = maximum vessel draft limited to berth depth	h = no shore-based ramps available
b = inadequate apron width	i = insufficient ramp clearance at low tide
c = inadequate berth length	j = insufficient ramp clearance at high tide
d = no straight stern-ramp facilities	k = excessive ramp angle at low tide
e = no container-handling equipment	m = excessive ramp angle at high tide
f = inadequate berth depth, adequate anchorage depth	n = parallel ramp operation only
g = inadequate channel depth	o = insufficient apron width for side-ramp operation

Note: Ramp clearance andramp angle based on maximum vessel draft.

III. APPLICATION

GENERAL

In this section, we evaluate the port's throughput capability for deploying a notional mechanized infantry division using mainly FSS vessels. The Planning Orders Digest, issued by MARAD, does not include agreements for military use of the Port of New Orleans. However, this analysis will consider what facilities would likely support military operations, in place of planning orders. Of the three terminal studied, military operations would likely occur at the France Terminal



France Terminal

REQUIREMENTS

The likely requirement for the Port of New Orleans is to deploy a notional mechanized infantry division in 6 days of reception and throughput. The division has to move about 7,800 vehicles and 600 containers. The movement to the port will require 1,055 (176 per day) railcars using the convoy/rail option. Under this option, about 3,654 (609 per day) roadable vehicles would be driven and about 2,321 (137 per day) would be towed.

MECHANIZED INFANTRY DIVISION

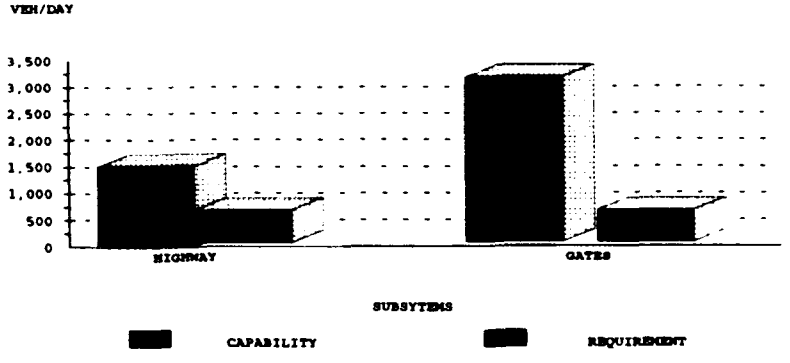
Total Equipment	
Volume	274,518 MTON
Weight	95,019 STON
Area	1,422,844 SQ FT
Vehicles	7,800
Containers	600

TERMINAL HANDLING

HIGHWAY

Vehicles and containers on chassis would access the terminals through the three-lane gate at berth 5-6, off France Road. Both the access road and the gate can handle more than 1,500 vehicles per day.

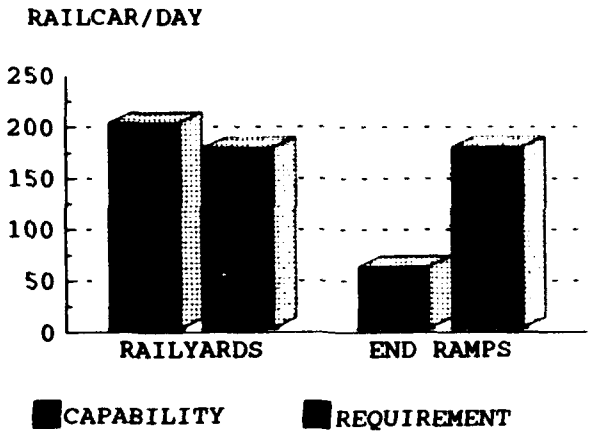
HIGHWAY INPROCESSING CAPABILITY



RAIL

The classification yards near the France Terminal could receive about 200 railcars per day. The two portable rail end ramps could offload 15 flatcars every 5 hours, or 60 per day. This offloading capability is insufficient to meet the requirement. Additional offsite portable end ramps are required.

RAIL INPROCESSING/HANDLING CAPABILITY

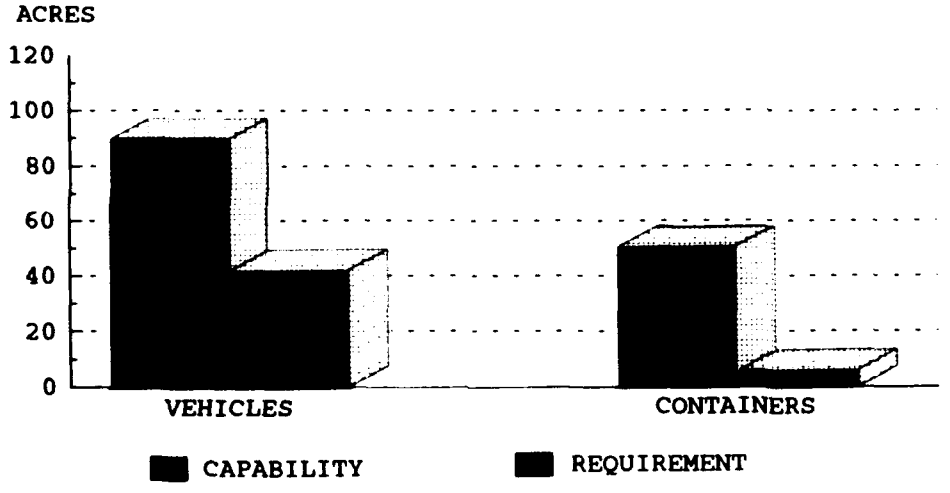


STAGING

Ten FSS-sized ships are required to deploy the entire division. This analysis assumes that current downsizing continues, and that 9 FSS-sized ships will deploy an entire notional mechanized infantry division. Three ships will depart every two days. Because of this, the staging requirement is to support three sustained loading operations. Although an FSS-load of cargo can be staged and loaded on 10 acres, 16 acres are required for sustained loading operations. Of these 16 acres, about 2 acres are required for the staging of the 73 containers for each FSS. The three simultaneous ship loading operations will require 48 acres of open staging, of which about 6 acres are dedicated to containers.

There are 137 acres of open staging that could support military operations. The France Terminal has enough staging area for the three simultaneous FSS-loading operations. The France Terminal has sufficient open staging to support the requirements.

OPEN STAGING CAPABILITY



SHIPPING

Although this analysis assumes that only nine FSS-sized ships can deploy the notional mechanized infantry division, the table at right provides ship quantities for the current division size. The number of ships required depends on the shipping mix selected. The best ship mix would consist of all eight FSS ships, plus two Cape H RORO ships.

FSSs and Cape H RORO ships cannot berth at the France Terminal. This is because the clearance below the Paris Road bridge (137 feet above MHW) restricts light FSSs and Cape H RORO ships from passing. For this reason, the France Terminal cannot meet the requirement to deploy the division by FSSs.

UNIT MOVEMENT REQUIREMENTS
MECHANIZED INFANTRY DIVISION

Minimum Containerization:				
All FSS*	8.00	1.93		
FSS and Cape H	6.69	3.00		
All Breakbulk			37.88	
Maximum Containerization:				
FSS and Container	7.95			2.00
FSS, Cape H and	4.67	3.00		2.00
Breakbulk and Container			29.61	2.00

*Only eight FSS are available. Unit shipping requirements exceed the capacity of these eight vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

Legend:
RORO - roll on/roll off
FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, Aug 91.

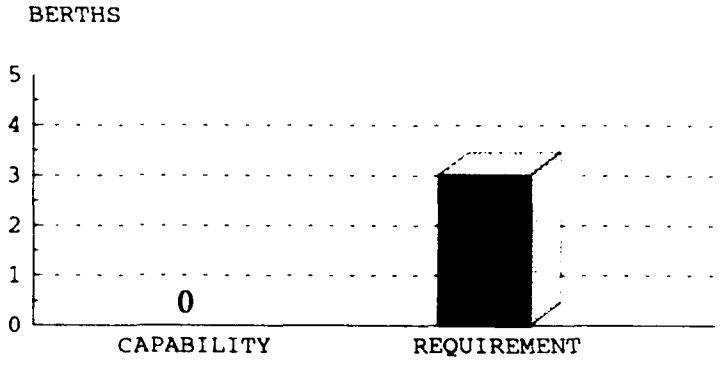
SUMMARY

Although the France Terminal has abundant open paved staging, it cannot accommodate FSSs. The port receiving capabilities are adequate, provided additional offsite rail end ramps are used.

RECOMMENDATION

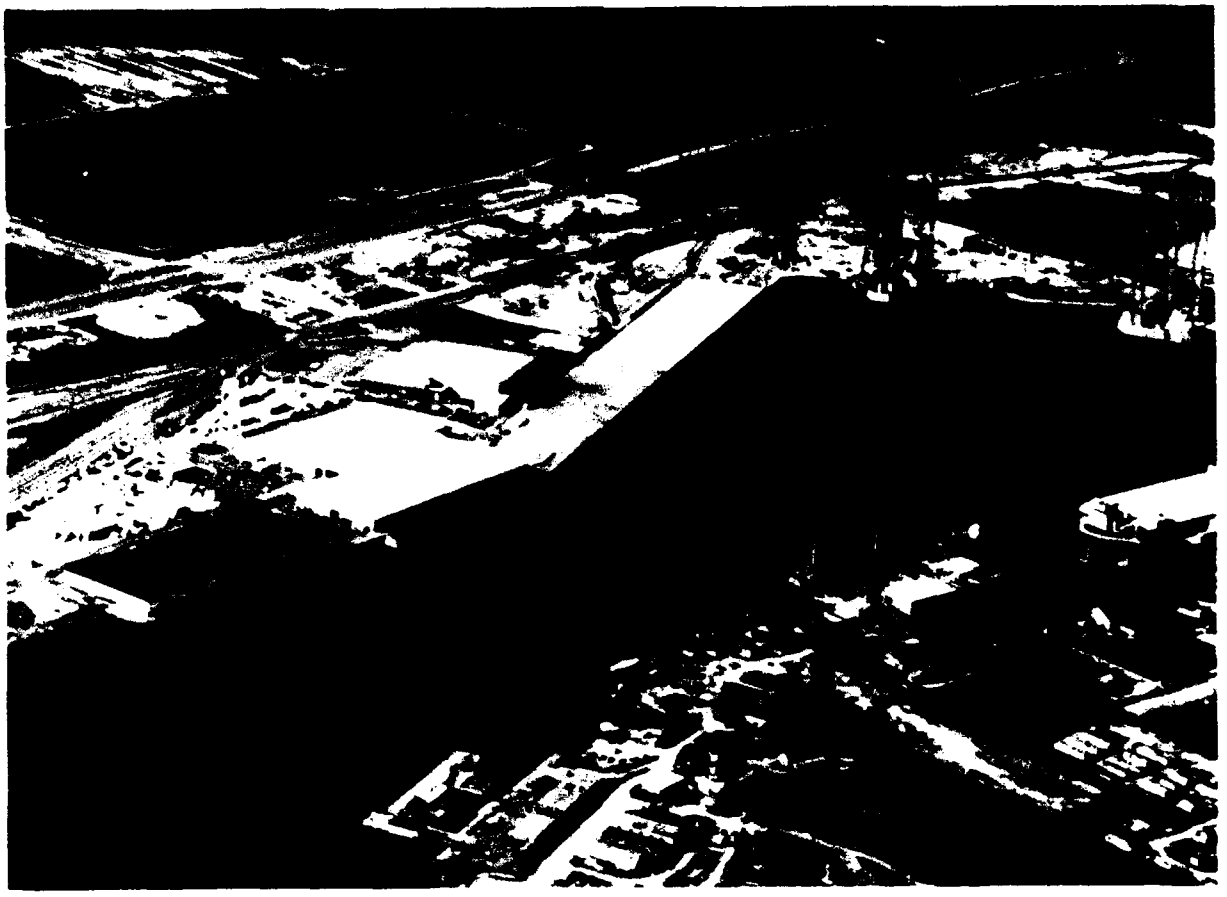
Designate only small RORO vessels to deploy military equipment from the France or Jourdan Terminal because of bridge and berth limitations.

FSS SHIPPING CAPABILITY



PORT OF PASCAGOULA

PASCAGOULA, MISSISSIPPI



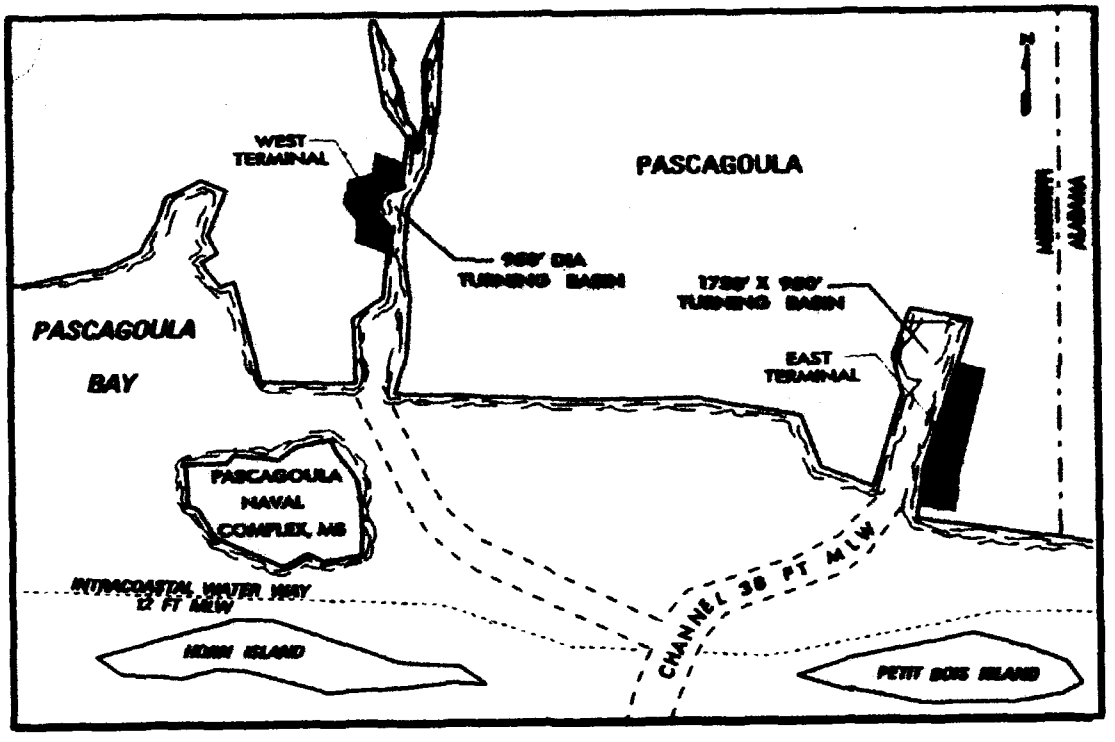
I. GENERAL DATA

TRANSPORTATION ACCESS

WATER

The Port of Pascagoula is in the southeastern tip of Mississippi, about 35 miles southwest of Mobile, Alabama. It consists of two terminals (West and East), which are about 11 miles apart by road.

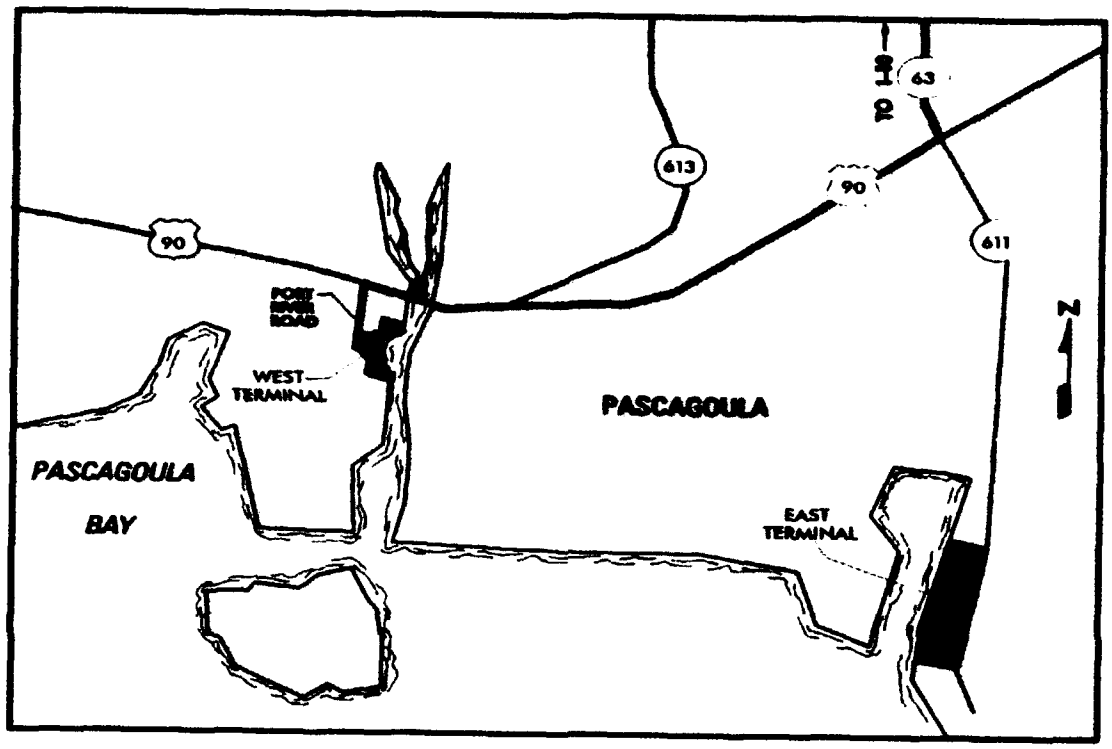
The channel from the port cuts through the Mississippi Sound, between two islands (Horn and Petit Bois), to the Gulf of Mexico. The channel is at least 38 feet deep mean low water (MLW) and 225 feet wide. Each terminal has a turning basin at its north end. No bridges cross the channel to either terminal.



Water Access

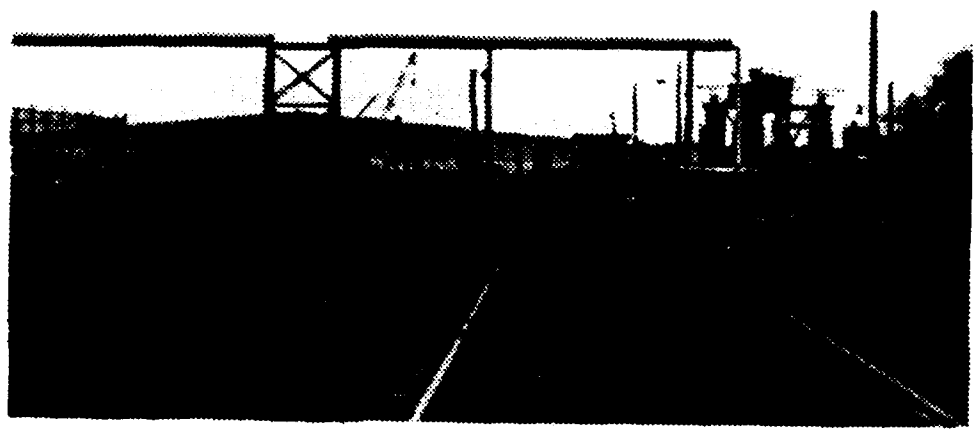
HIGHWAY

The Port of Pascagoula has access to Interstate Route 10 and US Route 90. From the East Terminal, access to I-10 and US 90 is via Mississippi Routes 611 and 63. Access to US 90 from the West Terminal is direct via Port River Road.



Highway Access

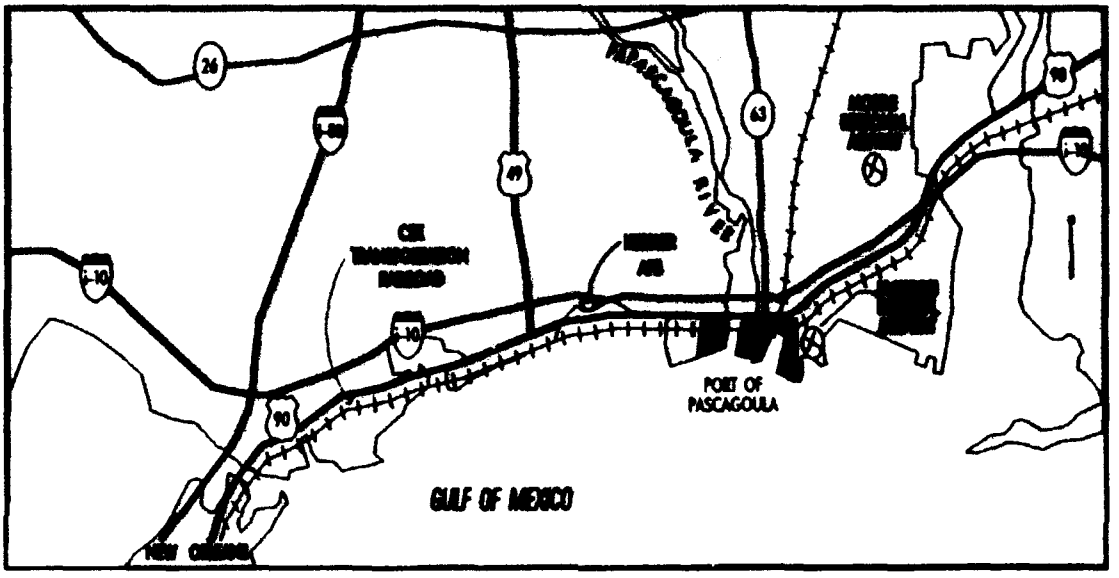
Each terminal has only one gate. The roads within the port are generally two laned. The terminals have very little congestion, except during commuting hours at the West Terminal. Access roads to the West Terminal are shared with the adjacent shipyard.



Gate at East Terminal

RAIL

The CSX Railroad serves the Port of Pascagoula and provides switching services. One track runs to each of the two terminals. Each terminal has a port-owned railyard, and a CSX railyard within 1 mile. These railyards have a capacity of 35 to 50 railcars. Rail clearances are sufficient for bilevel and trilevel railcars. However, no ramps are available.



Rail and Air Access

AIRPORTS

Mobile Regional Airport is the nearest major commercial airport. The nearest military airfield is Keesler Air Force Base.

Location			
Distance	East	North	West
Direction	35 miles	6 miles	25 miles
Main Runway			
Length	8,500 feet	8,500 feet	5,030 feet
Width	150 feet	150 feet	150 feet

PORT FACILITIES

BERTHING

The Port of Pascagoula is a two-terminal multicargo port with marginal wharves. The West Harbor has two general-cargo berths, which are 1,044 and 1,450 feet long. The East Harbor terminal has five berths, which are 516 to 737 feet long. Wharf construction at both terminals is concrete decking supported by concrete piles. All berths are fronted with timber fendering. Lighting is good except for berths C and D, which will require portable lighting for night operations.

Figures 1 and 2 are a land-use map and an aerial view of the West Terminal, respectively. Figures 3 and 4 are a land-use map and an aerial view of the East Terminal, respectively. The aerial views of the terminals also include tables that identify berth characteristics.

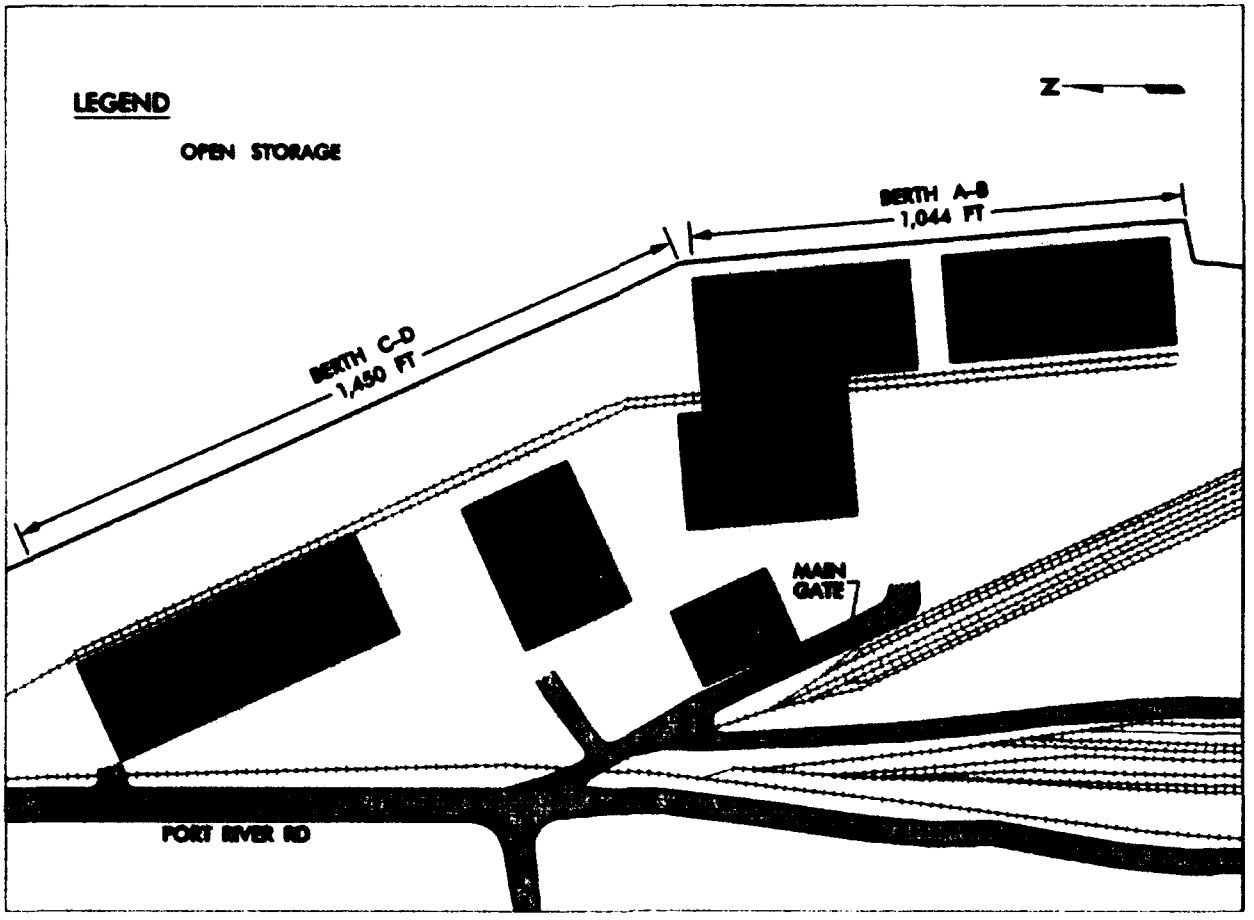
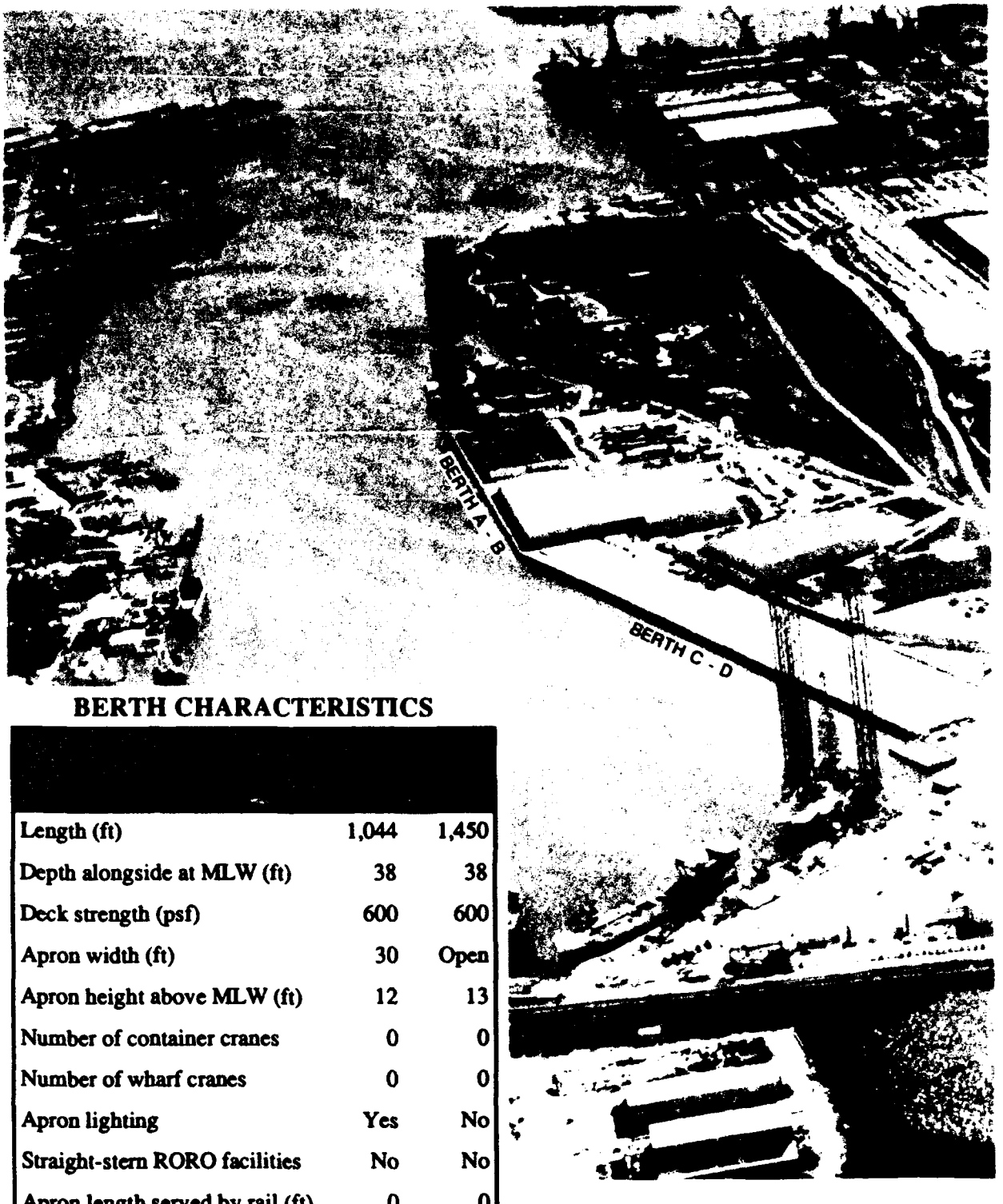


Figure 1. Land use map, West Terminal.



BERTH CHARACTERISTICS

Length (ft)	1,044	1,450
Depth alongside at MLW (ft)	38	38
Deck strength (psf)	600	600
Apron width (ft)	30	Open
Apron height above MLW (ft)	12	13
Number of container cranes	0	0
Number of wharf cranes	0	0
Apron lighting	Yes	No
Straight-stern RORO facilities	No	No
Apron length served by rail (ft)	0	0

Figure 2. West Terminal (southward view).

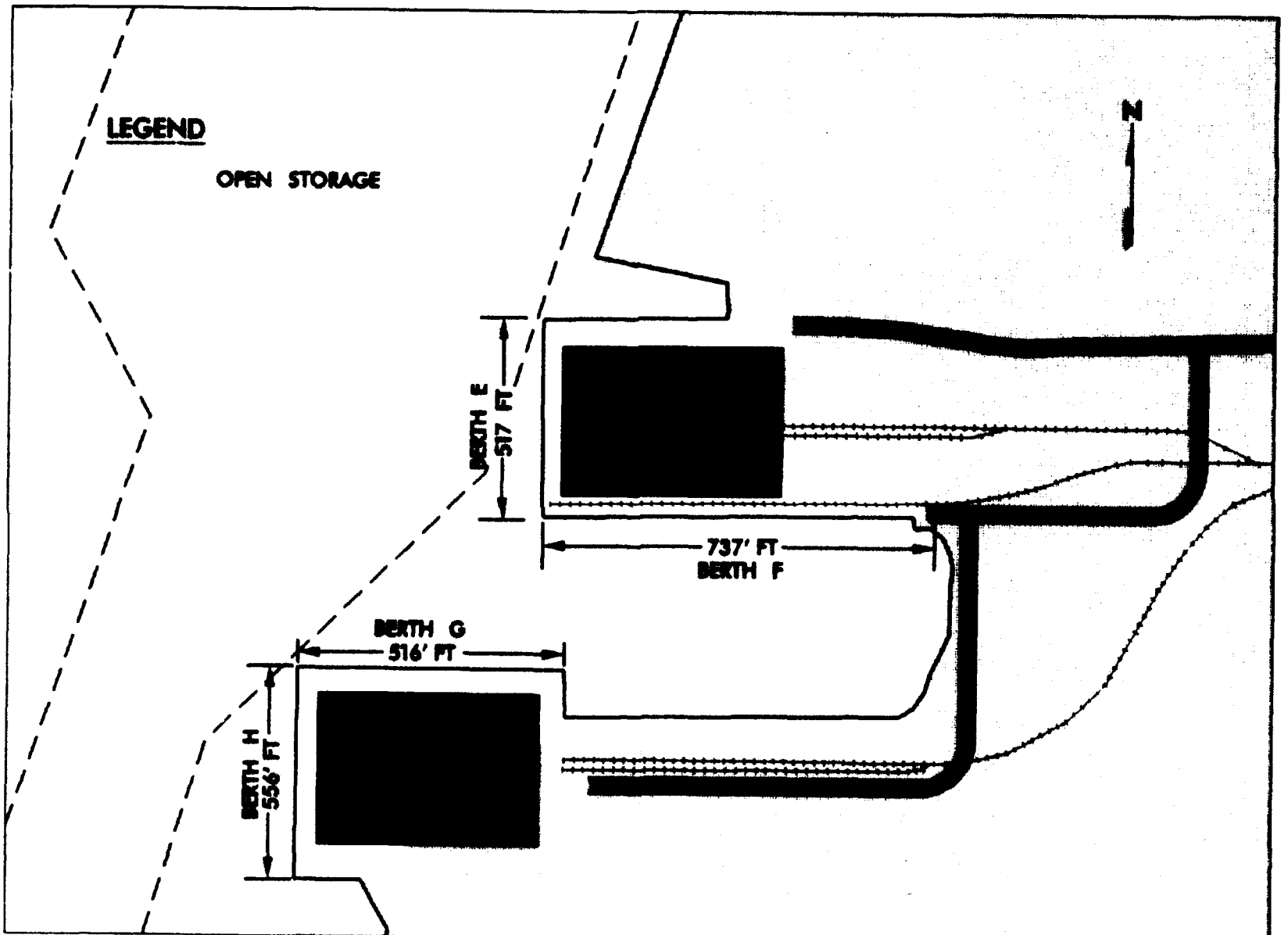


Figure 3. Land-use map, East Terminal.

BERTH CHARACTERISTICS

Length (ft)	517	737	516	556
Depth alongside at MLW (ft)	38	38	38	38
Deck strength (psf)	600	600	600	600
Apron width (ft)	37	55	60	34
Apron height above MLW (ft)	12	12	12	12
Number of container cranes	0	0	0	0
Number of wharf cranes	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No
Apron length served by rail (ft)	0	737	0	0

Figure 4. East Terminal (eastward view).

STAGING

Open Storage

The Port of Pascagoula has about 19 acres of open staging. Nine acres are paved. The remaining area is grass covered. Most of the paved area supports the West Terminal. The grass-covered area supports the East Terminal.

Open Staging at Berth C-D

Helicopter operations are limited at the West Terminal. To load, helicopters should land, reduce, and shrink wrap at Homeport Pascagoula. Commercial trucks with air suspensions should deliver the cocooned helicopters to the apron for ship loading.

At the East Terminal, helicopters could land on the grass-covered area. Either shed could support shrink-wrapping and reduction operations.

Covered Storage

The Port of Pascagoula has eight transit sheds, but two of them are refrigerated. Military equipment would not use refrigerated transit sheds. For this reason, this report only recognizes 670,000 square feet of covered staging. About half of this covered staging is at each of the two terminals.

Transit Shed at Berth C-D

RAIL

One CSX lead track serves the West Harbor. The track runs behind the wharf aprons and transit sheds and extends the entire length of the terminal (fig 1). Berth D and part of berth C open storage areas are platform-level high and provide side railcar-loading capability. A covered rail-loading platform is between transit sheds B and B backup.

CSX also provides one lead track to the East Harbor. The track splits into three rail spurs that serve the transit sheds at berths G, H, E, and F and the apron at berth F.

Railyards owned by the port have storage capacity for about 82 railcars. Railyards within 1 mile of the port can store another 85 cars.

HIGHWAY

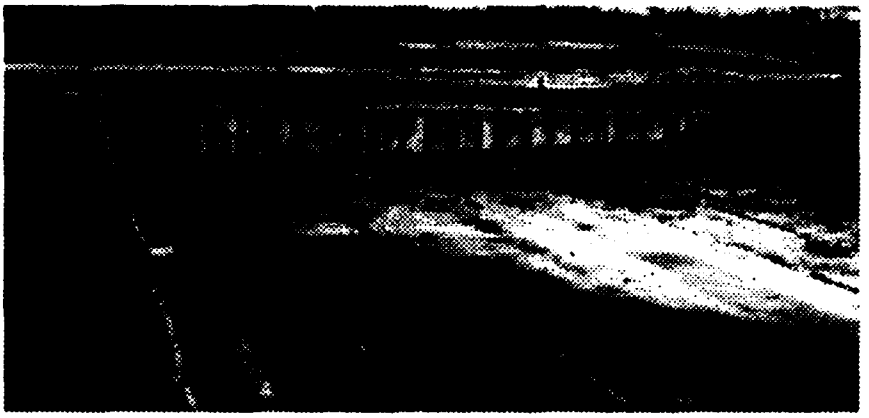
All of the roads within the terminals are two laned. The terminal roads have no clearance restrictions.

UNLOADING/LOADING POSITIONS

Ramps

The port has no rail end ramps suitable for military equipment. However, with minor modification, the ends of the tracks behind shed A (West Terminal) could support circus-style offloading.

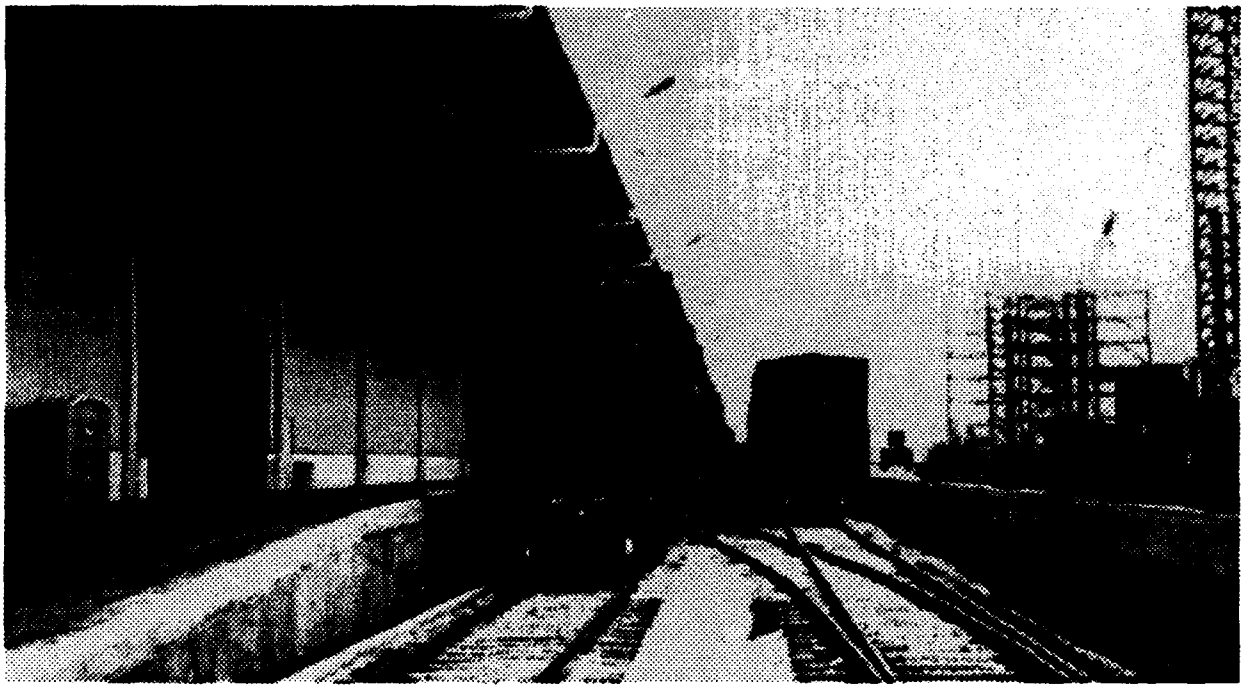
The West Terminal has a truck end ramp at the inland edge of the apron of berth C-D. This ramp can accommodate two trucks. The East Terminal has a truck end ramp at the apron extension of berth F. This ramp can also accommodate two trucks.



Track Ends at Transit Shed A

Docks

All the transit sheds have railcar-level platforms for boxcar unloading and truck-level docks for van unloading. The port can handle 57 boxcars and 8 vans simultaneously.



Boxcar Handling Positions at Transit Shed D

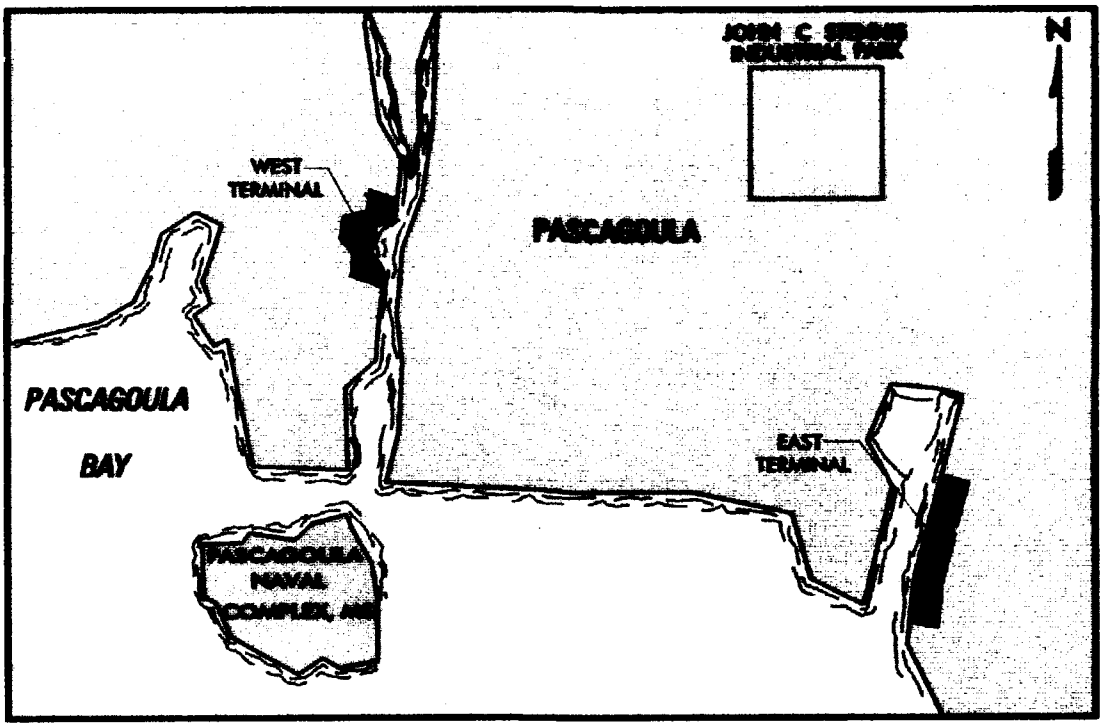
MARSHALING AREAS

Within Port

No marshaling areas are within the port. All open area within the port is required for staging.

Homeport Pascagoula

Homeport Pascagoula is built on a dredge-spoil island about 3 miles south of the West Terminal. The only access is a two-lane, 2.8-mile causeway. No rail access is available. A total of 180 acres are developed to support four frigates. Broken into several different areas, about 30 acres are available for marshaling. The frigate pier could support limited ship loading, if necessary.



Marshaling Areas

Stennis Industrial Park

This 605-acre area is about a mile north of the East Terminal. Formerly the Jackson County Airport, the land is slowly being developed for industrial use. One CSX rail spur runs into the center of the area. This rail spur is long enough to support the offloading of about 22 railcars. About 345 undeveloped and 15 paved acres are available for marshaling.

MATERIALS HANDLING EQUIPMENT (MHE)

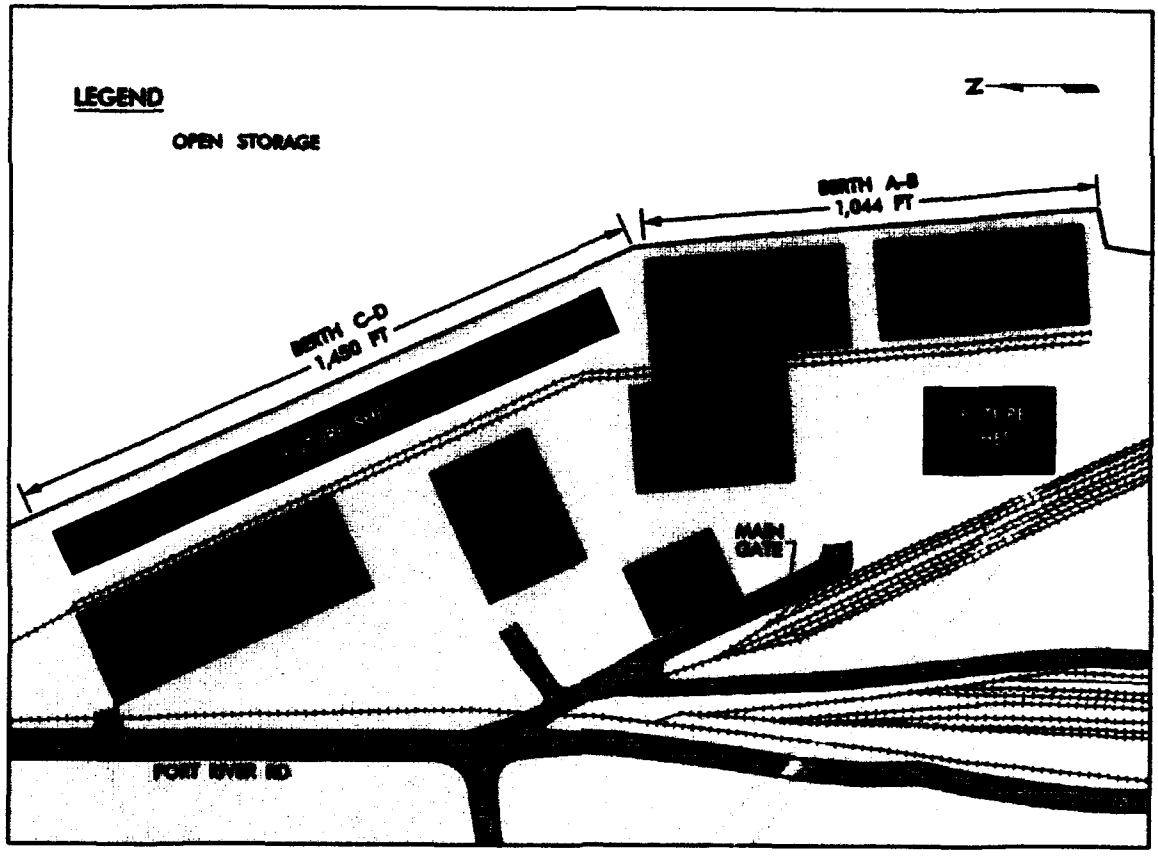
The port does not own any MHE. Various stevedore companies can provide mobile or floating cranes ranging in capacity from 20 to 80 STON.

INTERMODAL FACILITIES

The nearest intermodal railyards are in Mobile, Alabama. The PND report of the Port of Mobile provides information on these facilities.

FUTURE DEVELOPMENT

The port plans to build sheds at the West Terminal. A new shed covering the apron at berth D will add about 60,000 square feet of covered staging. A small shed (about 35,000 square feet) will be inland of berth A. Construction is expected to begin later this year.



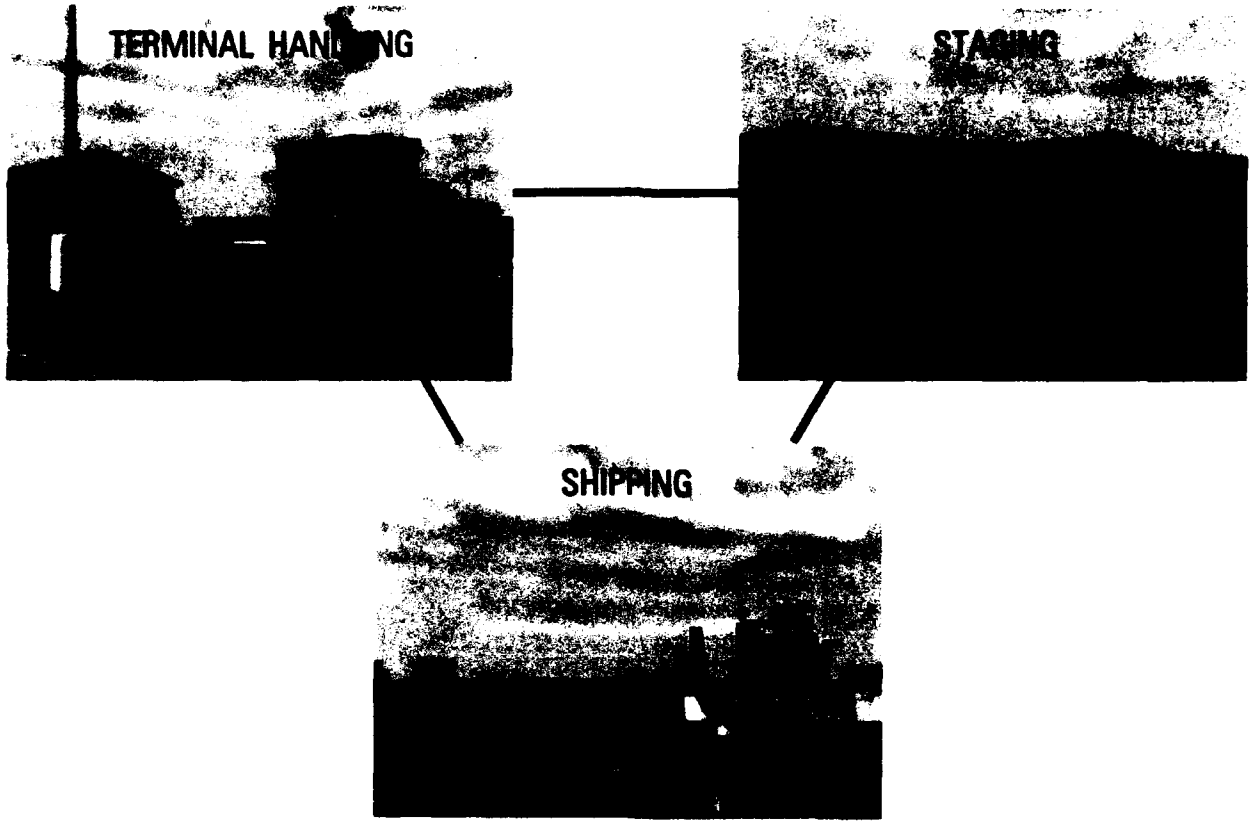
Future Sheds at the West Terminal

The port also expects to widen the East Terminal channel, and add a 1,150-foot turning basin south of the terminal. Work will begin in 1996.

II. THROUGHPUT ANALYSIS

GENERAL

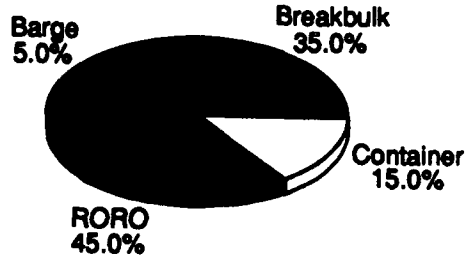
We evaluated the theoretical throughput capability of the Port of Pascagoula using the port operational performance simulator (POPS) computer model. The POPS model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least-capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/ handling - in short tons (STON) and measurement tons (MTON) per day.



Terminal Throughput Subsystems

The analysis assumes that 80 percent of the port facilities will support the military deployment. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.

SHIP MIX PERCENTAGES

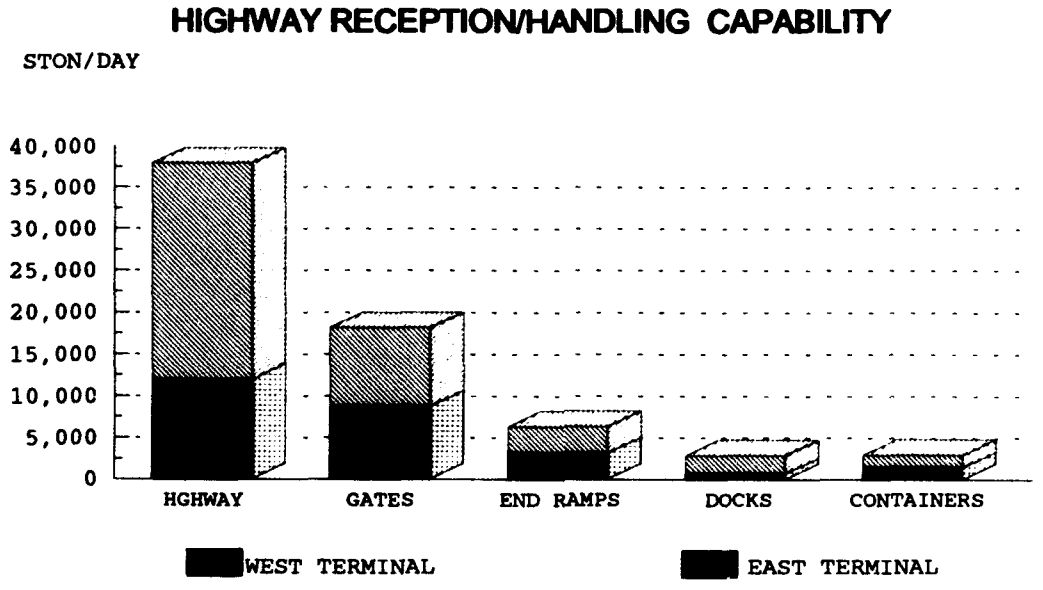


TERMINAL RECEPTION/HANDLING

HIGHWAY

Traffic to and from either terminal is restricted by two-laned roads. West Terminal access is via Port River Road. East Terminal access is via Mississippi 611. Each terminal has only one gate. The road network in and out of the port, including the gate processing of vehicles, could handle more than 18,000 STON of equipment and supplies per day. This capability is almost divided evenly between the two terminals.

Roadable vehicles in convoys will move directly to the staging areas. Vehicles on commercial or military flatbed trailers without integral ramps will offload at the two ramps on the railroad tracks just south of shed D, or the two ramps on the edge of the berth F apron. These ramps could offload more than 6,400 STON from flatbed trailers per day. Supplies in van semitrailers will proceed to the eight handling positions. These truck docks can offload about 3,000 STON of van semitrailer-shipped material per day. Containers on trucks will move to the staging area to be offloaded. A container handler will offload 1,500 STON in containers from their chassis per day at each terminal.

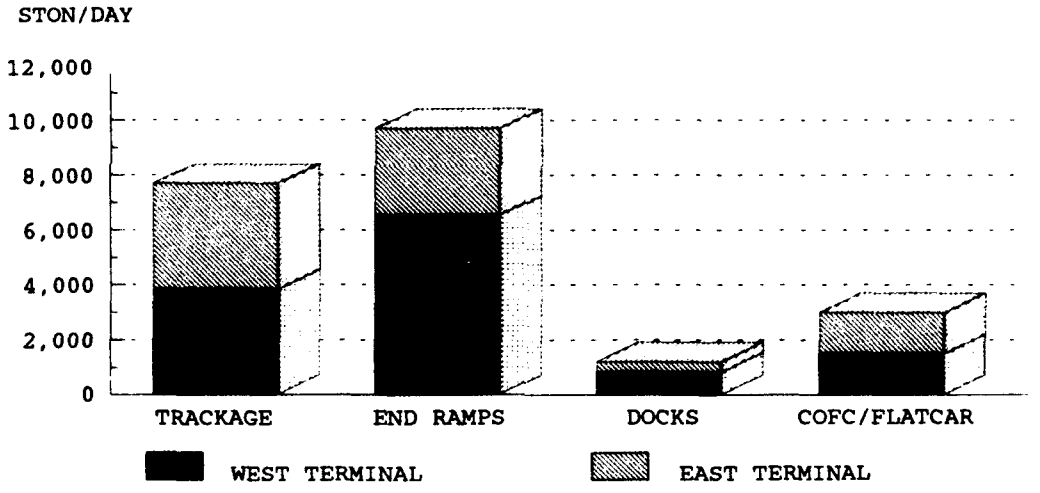


RAIL

Port-owned railyards could store 82 railcars. Also, commercial railyards within a mile of the port could store 85 additional railcars. Only CSX provides rail service to the port. On an average day, one 30-railcar train goes to each terminal. If necessary, each train could be as long as 100 railcars.

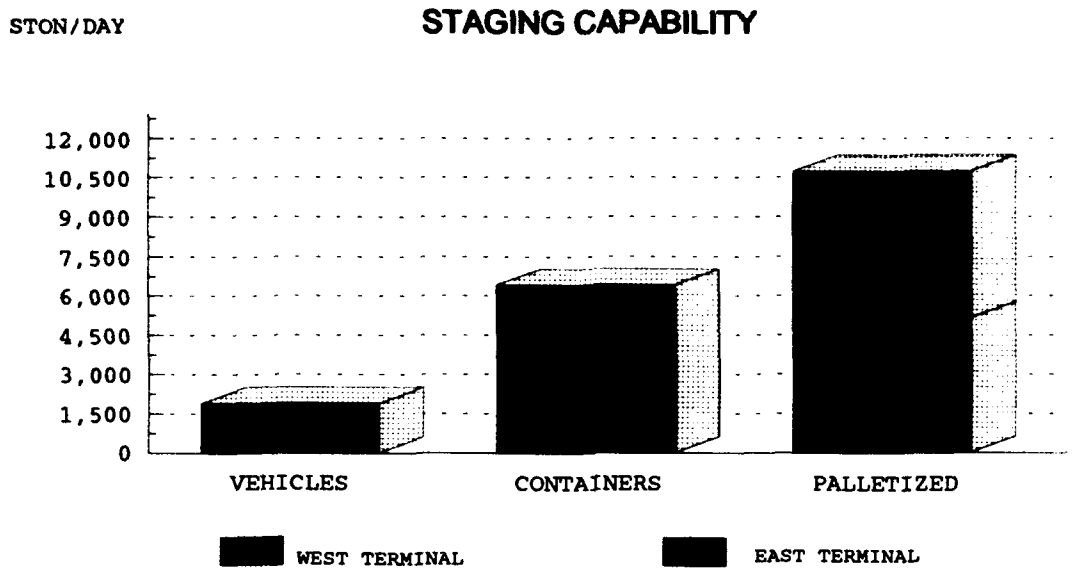
With fabricated end ramps, vehicles on about 28 flatcars could circus-style offload at the ends of the two tracks behind shed A. The apron track at berth F could also support circus-style offloading of eight railcars with a portable end ramp. About 11 boxcars could be unloaded on the track next to shed D. Tracks inside of sheds E and F and G and H can support the unloading of about 27 boxcars. A container handler will offload 1,500 STON in containers from flatcars per day at each terminal.

RAIL RECEPTION/HANDLING CAPABILITY



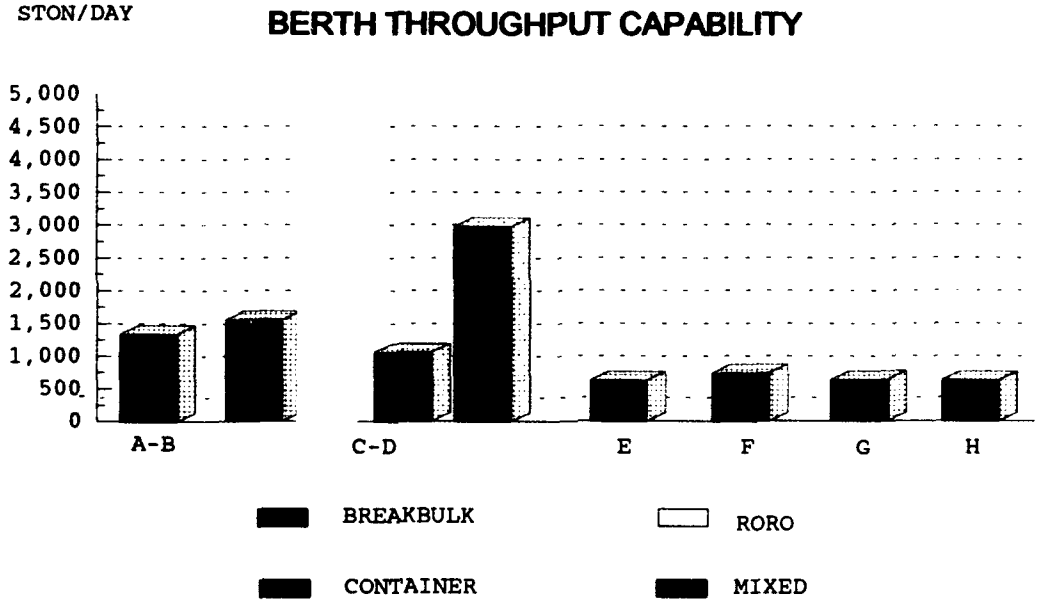
STAGING

The port has about 19 acres of open staging area for vehicles and/or containers. Also, about 670,000 square feet of covered staging are available.



SHIPPING

We identified the throughput capability per berth in STON per day for breakbulk, RORO, container, and mixed vessels. These results were based on various factors, including MHE used, loading, operational and berth usage rates, as well as berth and ship compatibility.



The berth and ship compatibility for various vessel types is shown in table 1. The table also provides the limitations that can hinder shipping operations.

TABLE 1
SUMMARY OF PASCAGOULA BERTHING CAPABILITIES

Breakbulk						
C3-S-33a	2	2	1	1	1	1
C3-S-37c	2	2	1	1	1	1
C3-S-37d	2	2	1	1	1	1
C3-S-37a	2	2	1	1	1	1
C4-S-1a	1	2	c	1	c	c
C4-S-1qb and 1u	1	2	c	1	c	c
C4-S-58a	1	2	c	1	c	c
C4-S-65a	1	2	c	1	c	c
C4-S-66a	1	2	c	1	c	1
C4-S-69b	1	2	c	1	c	c
Seatrain						
GA and PR-class	1	2	c	1	c	c
Barge						
LASH C8-S-81b	1	1	c	c	c	c
LASH C9-S-81d	1	1	c	c	c	c
LASH lighter	7	10	3	5	3	3
SEABEE C8-S-82a	a,g	a,g	a,c,g	a,c,g	a,c,g	a,c,g
SEABEE barge	5	7	2	3	2	2
RORO						
Comet	d,o	d,i,j	d,o	d,o	d,o	d,o
C7-S-95a/Maine-class	b	1	b,c	b	c	b,c
Ponce-class	b,h	h	b,c,h	b,h	b,c,h	b,c,h
Great Land-class	b,h	h	b,c,h	b,c,h	b,c,h	b,c,h
Cygnus/Pilot-class	b	2	b,c	b	c	b,c
Meteor	d,o	d,i,j	c,d,o	d,o	c,d,o	d,o
AmEagle/Condor	b	i,j	b,c	b	c	b,c
MV Ambassador	d	d	c,d	d	c,d	d
FSS-class	b	1	b,c	b,c	c	b,c
Cape D-class	b	i,j	b,c	b	c	b,c
Cape H-class	b	1	b,c	b,c	c	b,c
Container						
C6-S-1w	1,e	2,e	c,e	1,e	c,e	c,e
C7-S-68e	1,e	1,e	c,e	1,e	c,e	c,e
C8-S-85c	1,e	1,e	c,e	c,e	c,e	c,e
Combination						
C5-S-78a	1,e	2,e	c,e	1,e	c,e	c,e
C5-S-37e	1,e	2,e	c,e	1,e	c,e	c,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

The type of ship preferred at each berth is based on the methodology described in the appendix. The evaluation is based on a snapshot view of the current physical characteristics of the berths and the MHE available. The evaluation gives no considerations for enhancements, such as equipment.

Berths C and D provide the largest throughput capacity for container and RORO vessels. Also, this berth is compatible for all ship types.

PREFERENCE BERTH SELECTION

Breakbulk	3	2	4	1	4	4
RORO	-	1	-	-	-	1
Container	-	1	-	-	-	-

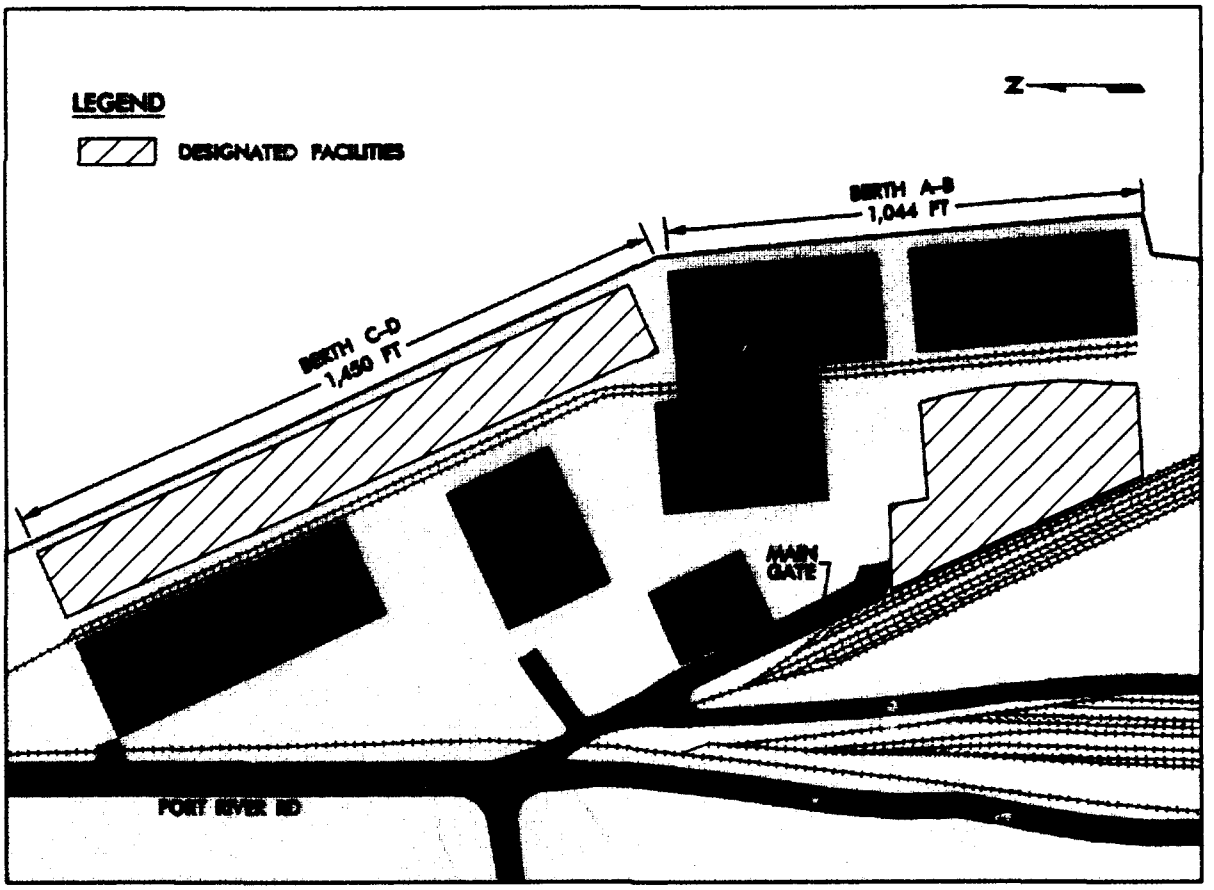
NOTE: Berths marked "-" are not recommended for these operations.

III. APPLICATION

GENERAL

This section will evaluate the port's throughput capability for deploying a notional mechanized infantry brigade using three FSSs.

The *Planning Orders Digest,* issued by MARAD, does not include agreements for military use of the Port of Pascagoula. However, this analysis will consider what facilities would likely support military operations, in lieu of planning orders. Only berths C and D can support FSS operations. Therefore, this report analyzes operations at berths C and D, with all of the West Terminal's 8.25 acres of paved area for staging.



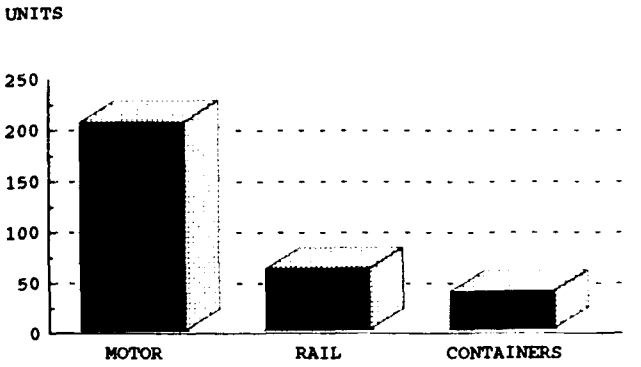
REQUIREMENTS

The likely requirement for the Port of Pascagoula is to deploy a notional mechanized infantry brigade in 6 days of reception and throughput. The brigade has to move about 2,600 vehicles and 220 containers. The movement to the port will require 360 (60 per day) railcars using the convoy/rail option. Under this option, about 1,220 (205 per day) roadable vehicles would be driven and about 775 (130 per day) would be towed.

MECHANIZED INFANTRY BRIGADE

Total Equipment	
Volume	91,506 MTON
Weight	31,670 STON
Area	474,300 SQ FT
Vehicles	2,600
Containers	220

DAILY DEPLOYMENT REQUIREMENT

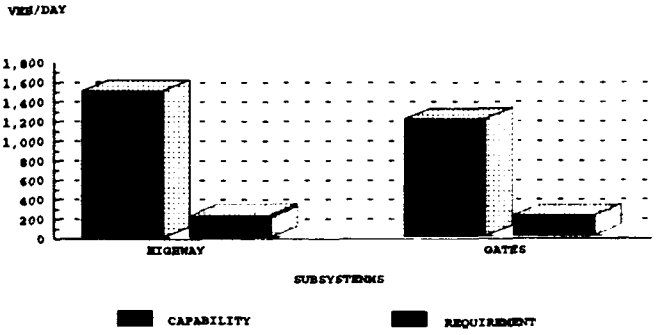


TERMINAL HANDLING

HIGHWAY

Both the access road and the West Terminal gate can handle an additional 1,200 vehicles per day.

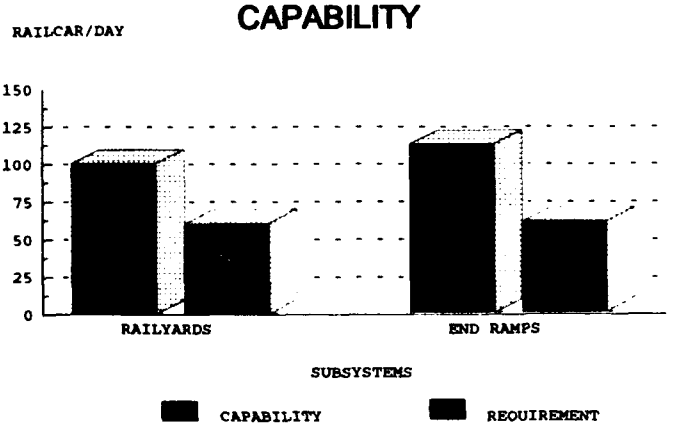
HIGHWAY INPROCESSING CAPABILITY



RAIL

The railyard within the terminal could receive 100 railcars per day of military vehicles and equipment. Also, the two rail end ramps could offload 28 flatcars every 5 hours, or 112 per day.

RAIL INPROCESSING/HANDLING CAPABILITY



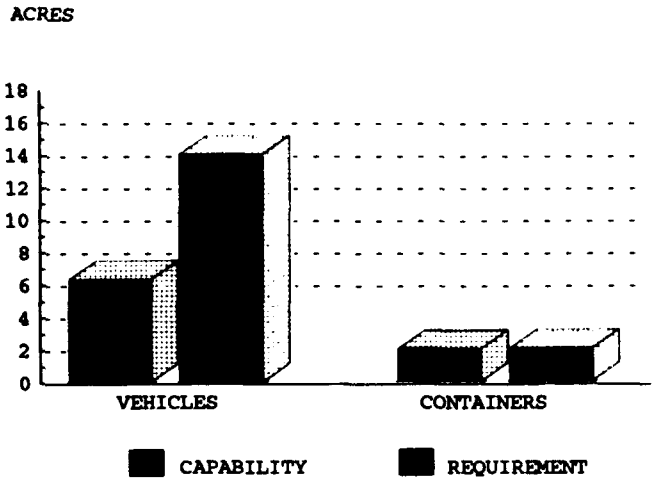
STAGING

This analysis assumes that current downsizing continues and that three FSS-sized ships will deploy an entire notional mechanized infantry brigade. One ship will depart every 2 days. Although an FSS cargo load can be staged on 10 acres, 16 acres are required for a sustained loading operation. Of these 16 acres, about 2 acres are required for staging the containers for each FSS.

There are only 8.25 acres of open staging that could support military operations. Because of this, some vehicles would have to stage on nearly 8 acres outside the port.

Convoy vehicles could use Homeport Pascagoula's grass-covered areas for the additional staging. The rail-deployed vehicles and the containers should receive priority for staging area within the port.

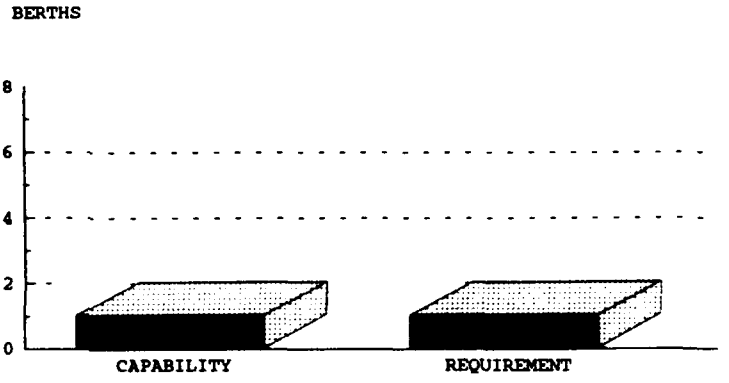
OPEN STAGING CAPABILITY



SHIPPING

Although this analysis assumes that only three FSS-sized ships can deploy the notional mechanized infantry brigade, the table below provides ship quantities for the current brigade size. The number of ships required depends on the shipping mix selected. The best ship mix would consist of 3.33 FSSs.

FSS SHIPPING CAPABILITY



UNIT MOVEMENT REQUIREMENTS
MECHANIZED BRIGADE

[illegible]	VESSEL TYPES			
[illegible]	FSS (RORO/CONT)	CAPE H (RORO/CONT)	C3/C4 (BREAKBULK)	C5/C7/C8 (CONTAINER)
Minimum Containerization				
All FSS	3.33			
FSS and Cape H	2.22	1.00		
All Breakbulk			12.57	
Maximum Containerization				
FSS and Container	2.64			0.67
FSS, Cape H, and Container	1.54	1.00		0.67
Breakbulk and Container			9.86	0.87

Legend:

RORO - roll on/roll off

FSS - fast sealift ship

SUMMARY

The berthing restrictions of the FSS vessels limit the Port of Pascagoula to one FSS support system. The port receiving capabilities can support FSS operations, however additional staging area is required. The mechanized infantry brigade can deploy in the 6-day receiving period.

RECOMMENDATIONS

1. Designate only one brigade of equipment to deploy through the Port of Pascagoula because of berth limitations.

2. Designate berth C-D, all open staging at the West Terminal, and at least 8 offsite acres to support the one FSS vessel system.

PORT OF PORT ARTHUR

PORT ARTHUR, TEXAS

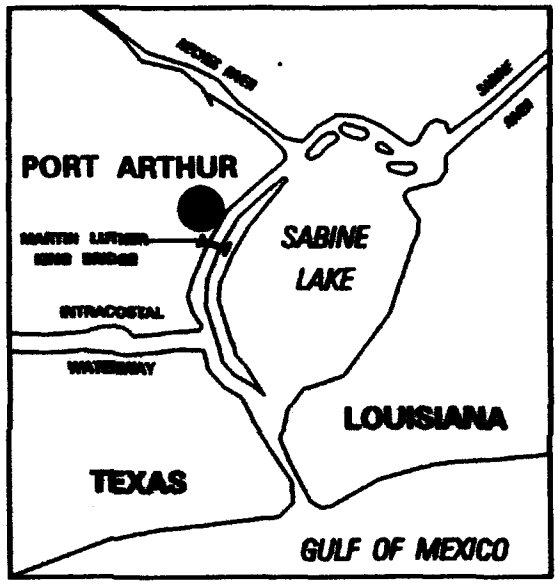
I. GENERAL DATA

TRANSPORTATION ACCESS

WATER

The Port of Port Arthur is 19 nautical miles above the Sabine Pass entrance from the Gulf of Mexico, on the western side of Sabine Lake. The port is 5 miles west of the Texas/Louisiana border and 85 miles east of the Houston city limits.

Access to the Port of Port Arthur is via the Port Arthur and Sabine-Neches Canals. The Sabine Pass entrance from the gulf is at least 40 feet deep at mean low water (MLW) and at least 500 feet wide. The rest of the route to the Port of Port Arthur is 40 feet deep at MLW and at least 400 feet wide. The channel continues 29 miles above the Port of Port Arthur to the Port of Beaumont.



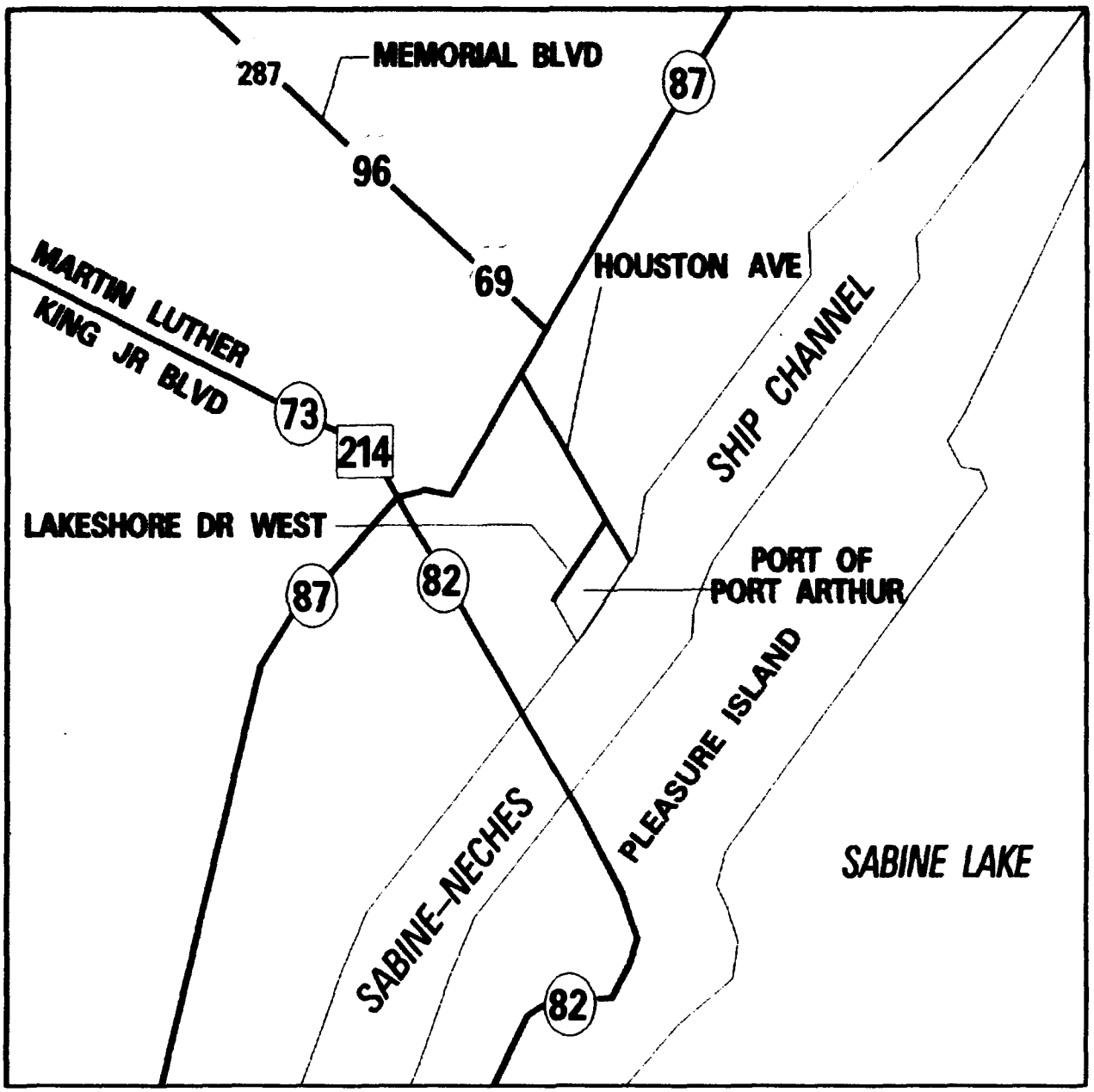
Water Access

A 900-foot-diameter turning basin, with a 40-foot depth at MLW, is less than a mile north of the port. According to Navy standard operating procedures, ships do not normally turn in an area that is less than 1.5 times their length. Based on this guideline, Navy ships more than 600 feet long will not normally use this basin.

The only bridge between the Gulf of Mexico and the Port of Port Arthur is on Martin Luther King Boulevard, Texas Route 82. It has a horizontal clearance of 400 feet and a vertical clearance of 138 feet at mean high water (MHW). It crosses the Sabine-Neches Canal 1 mile below the port.

HIGHWAY

The main routes to the port are US Routes 69, 96, and 287 (from northwest) and Texas Routes 87 (from north or south), 73 (from west), and 82 (from east). Main Gate is on Lakeshore Drive West.



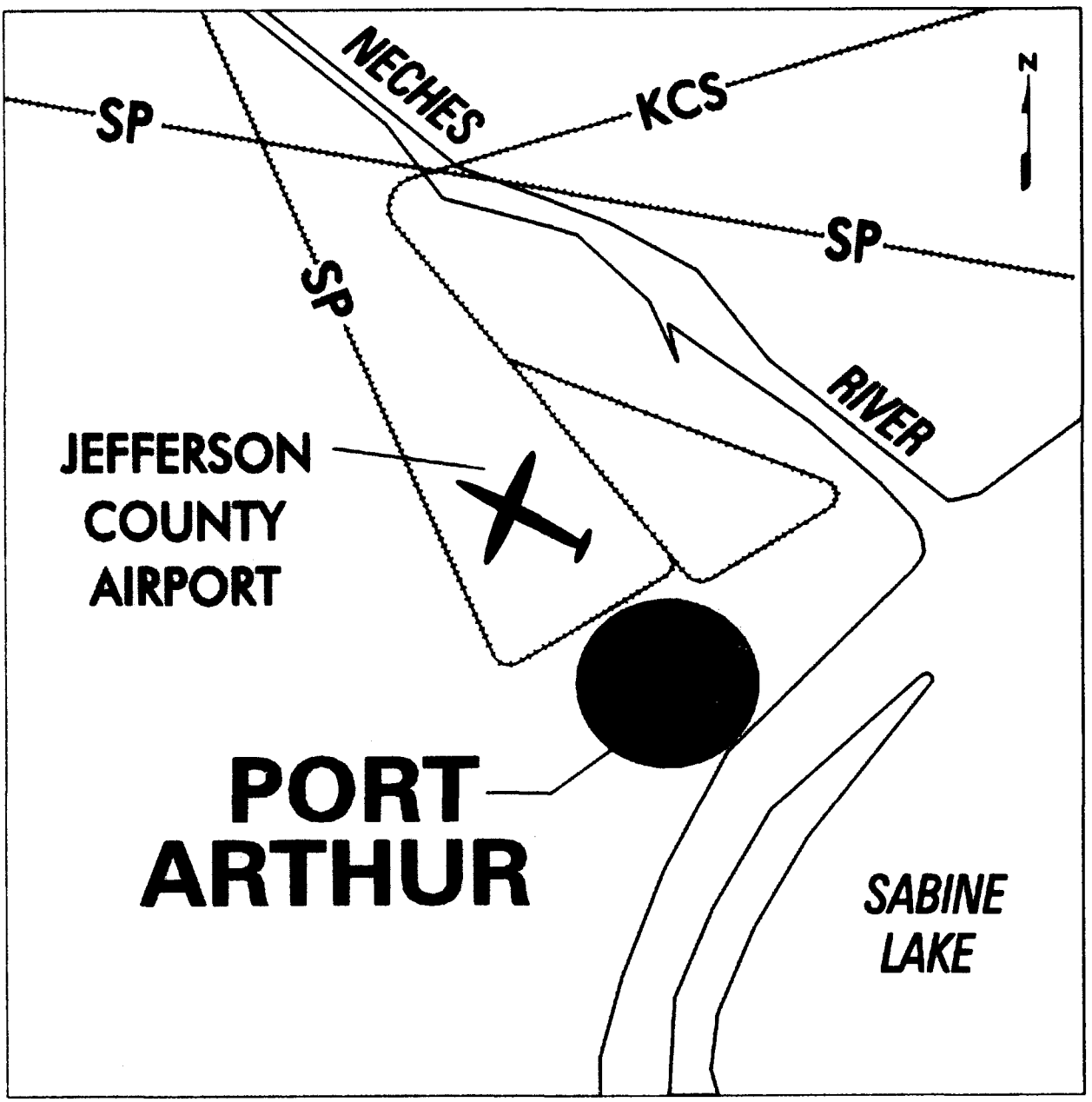
Highway Access

RAIL

Kansas City Southern (KCS) serves the port directly, and Southern Pacific (SP) serves the port under a long-term reciprocal switching agreement.

AIR

The nearest airport is the Jefferson County Airport. The airport has two commercial runways. One is 5,070 feet long, and the other is 6,750 feet long. Both are 150 feet wide. The nearest military airfield, at Ellington Air Force Base, is about 80 miles from the Port of Port Arthur.



Rail and Air Access

PORT FACILITIES

BERTHING

The Port of Port Arthur has berths numbered 1 and 2. These berths form a single wharf 1,200 feet long, with a depth alongside that is 40 feet at MLW. Dolphins allow for ship overhangs at each end of the wharf. The apron is 100 feet wide along berth 1 and most of berth 2. At berth 2, 120 feet of the wharf has an open apron. The Port of Port Arthur has a 6-foot-high fence around the perimeter. There is lighting throughout the port and around the perimeter. Main Gate is manned 24 hours per day.

BERTH CHARACTERISTICS

Length (ft)	1,200
Depth alongside at MLW (ft)	40
Deck strength (psf)	800
Apron width (ft)	100*
(120 ft of berth 2 has an open apron)	
Apron height above MLW (ft)	15
Number of container cranes	0
Number of wharf cranes	1
Apron lighting	Yes
Straight-stem RORO facilities	No
Apron length served by rail (ft)	1,200

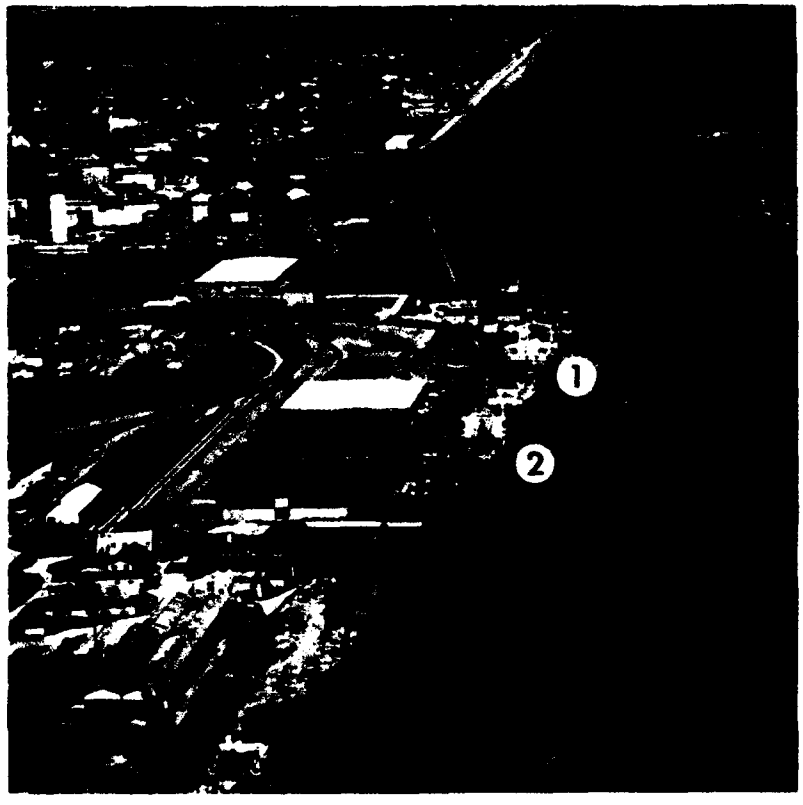


Figure 2. Aerial view of Port of Port Arthur Ocean Terminal and berth characteristics.

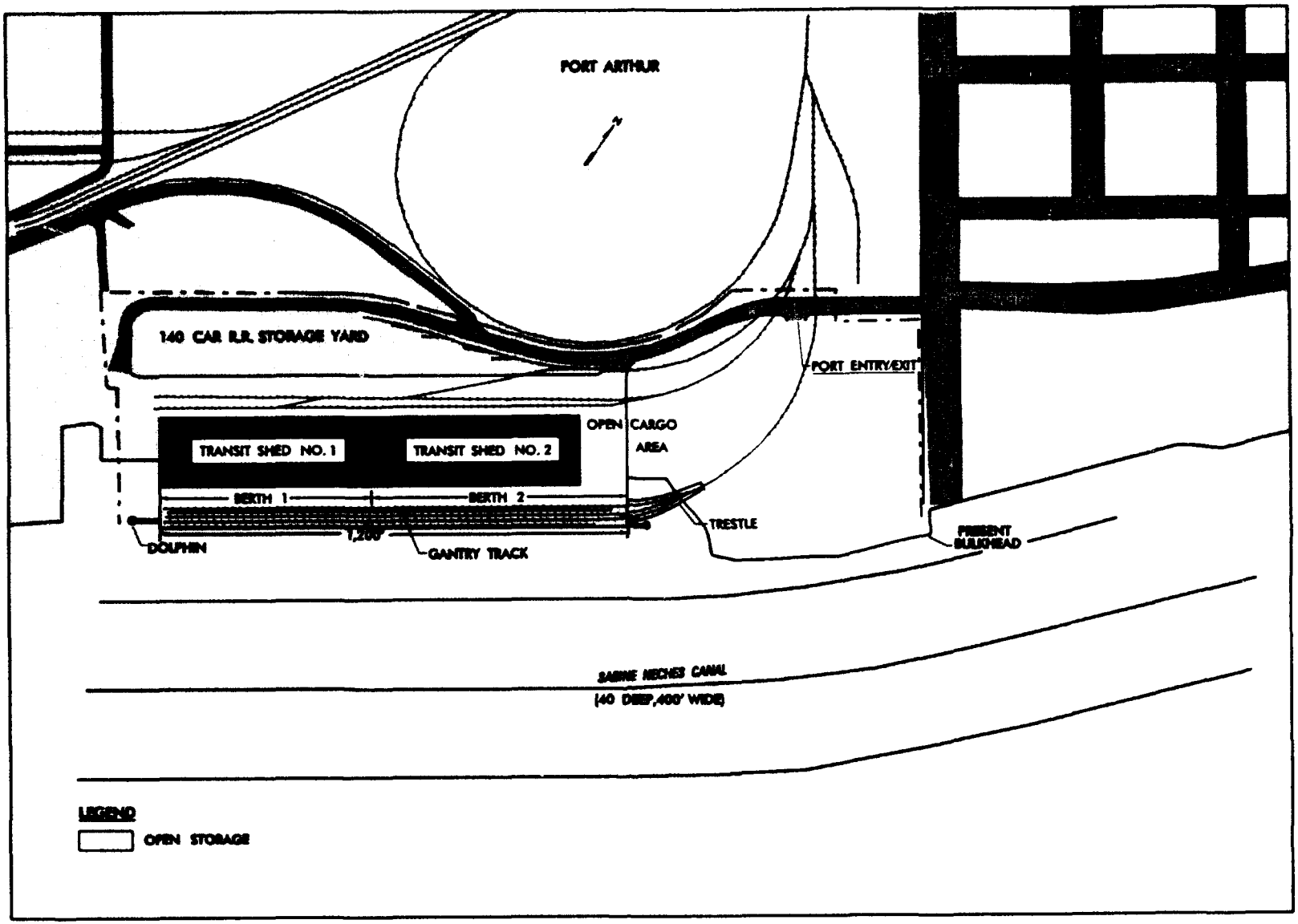


Figure 1. Site map.

STAGING

Open Staging

The port has 125,000 square feet (about 3 acres) of asphalted open storage area behind the transit shed.

The best location for helicopter operations is the staging area northeast of the transit sheds. After removing the rotor blades, the port support activity (PSA) can tow the helicopters into the transit shed for further reduction and shrink wrapping.

Open Staging for Port of Port Arthur Along Apron of Berths 1 and 2

Covered Staging

Covered storage consists of a transit shed with 194,400 square feet of covered storage area.

RAIL

Before entering Main Gate of the port, the track diverges into three tracks (fig 1). One of these tracks leads to the wharf. This track diverges into three tracks that run the entire length of the wharf, providing space for 60 railcars. All three tracks are within reach of the 75-ton crane. This arrangement provides excellent direct transfer of cargo.

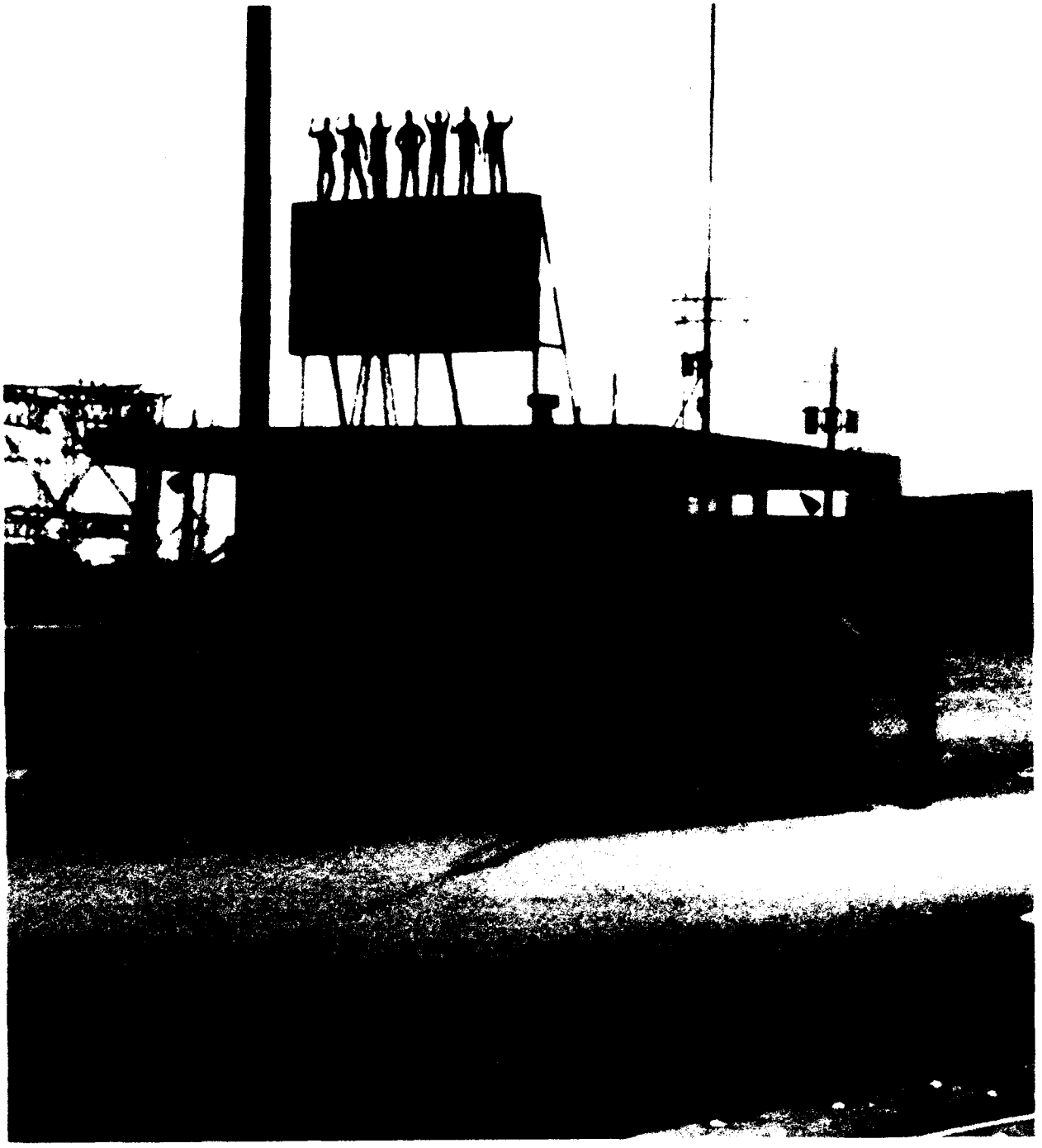
Another track leads to the inland side of the transit shed. This track diverges into two platform-level tracks that run the entire length of the transit shed.

The third track leads to a storage yard inland from the transit shed. This track diverges into several tracks that provide storage space for about 140 railcars.

Rail clearances to the port are sufficient for bilevel and trilevel railcars. However, the port has no ramp equipment for these railcars.

HIGHWAY

The Port of Port Arthur has only one access gate. No clearance restrictions are inside the port facility. The access to the cargo storage area and apron is paved. The maximum loading limit on the apron, inside the transit shed, and cargo storage area is 800 psf. The port has no truck scales.



Main Gate at Port of Port Arthur

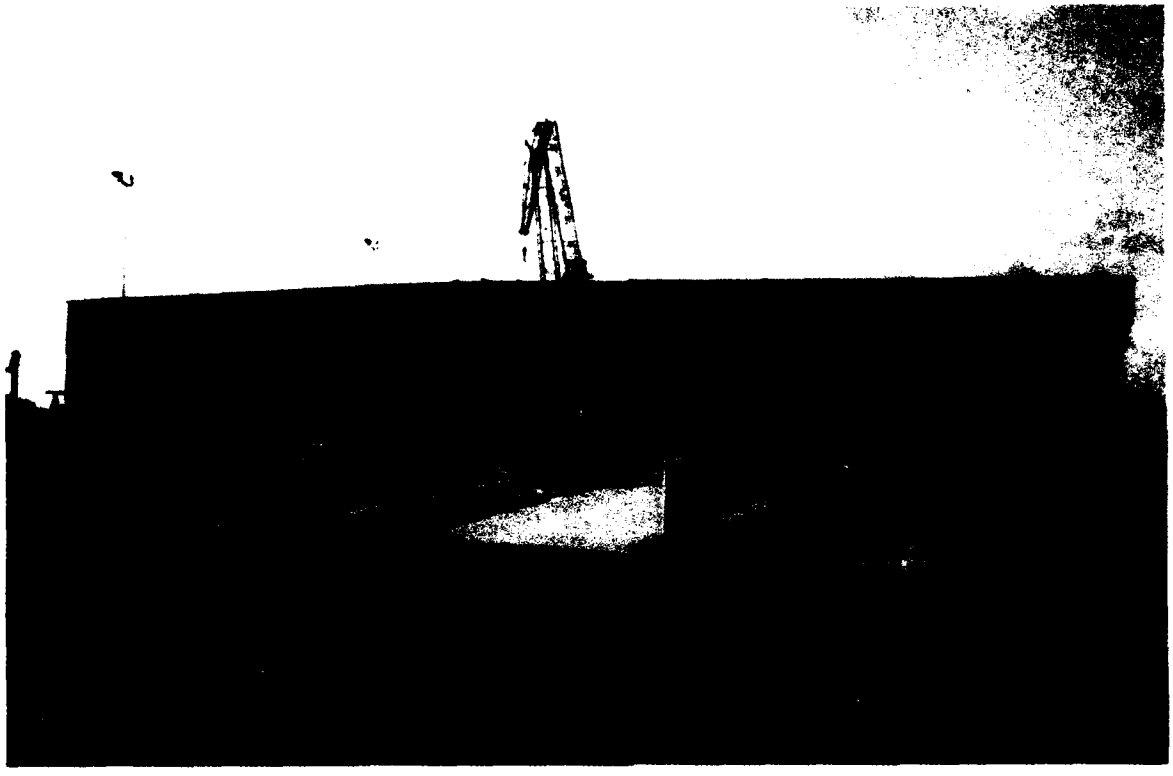
UNLOADING/LOADING POSITIONS

Ramps

The Port of Port Arthur has no end ramps available for loading or unloading railcars circus style.

Docks

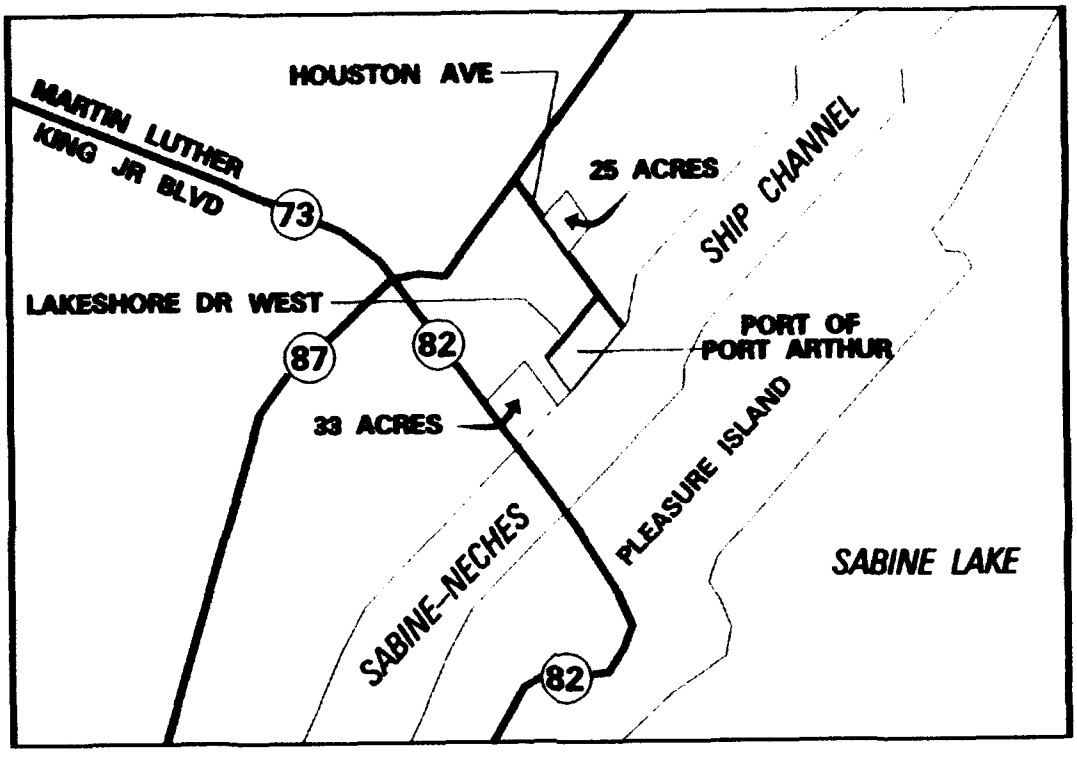
One hundred five truck docks are along the transit shed of berth 2. A ramp allows access to the truck docks. Also, two platform-level railroad tracks run along the inland side of the transit shed. The transit shed platform allows easy access onto the railcars from the transit shed. The 75-ton crane has access to all railcars parked on the apron.



Port of Port Arthur Unloading/Loading Facilities on Northeast Side of Transit Shed

MARSHALING AREAS

Two areas exist that are suitable for marshaling. Neither of these areas has pavement, drainage, lights, or fencing. Both areas are near railroad tracks. The marshaling area that is nearer to the port is on the southwest side of the port. The port authority recently purchased this land (33 acres) and plans to develop it into additional port facilities. The other area is about a quarter mile inland from Main Gate. It contains 25 acres of land northeast of Houston Avenue and is owned by the port.



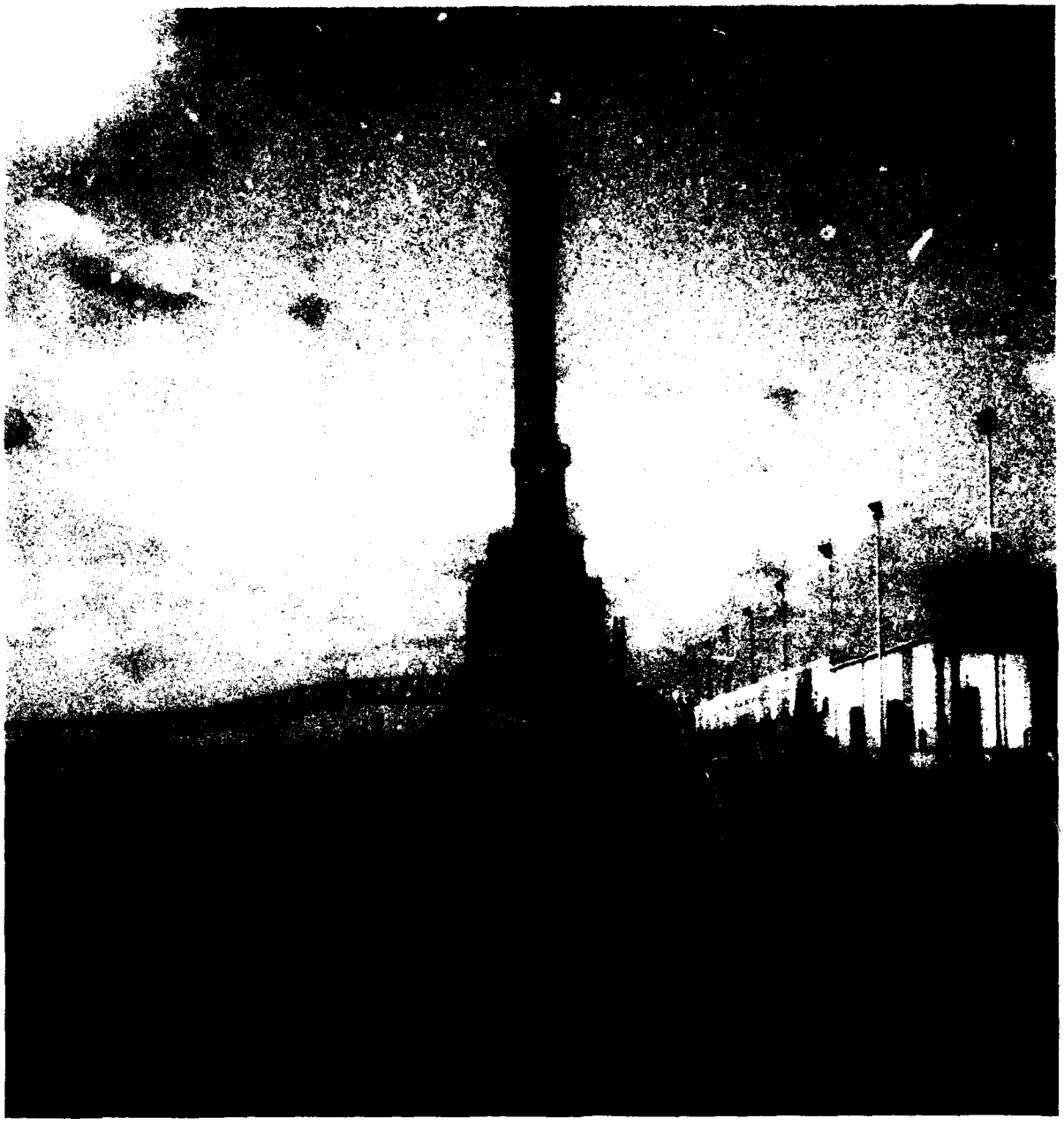
Port of Port Arthur Designated Marshaling Areas

Marshaling Area Southwest of Port

MATERIALS HANDLING EQUIPMENT (MHE)

"Big Arthur," the port's 75-ton revolving gantry crane, travels the length of the wharf. Three railroad tracks also run the length of the wharf and are accessible by the crane for direct loading and unloading.

The port does not own any MHE except for the 75-ton gantry crane. Local stevedore companies furnish all other equipment. Stevedore companies frequently use 50- to 75-ton mobile cranes. Mobile cranes with capacities up to 300 tons are available. Stevedore companies can also provide container handling equipment.



"Big Arthur" at Berths 1 and 2

INTERMODAL FACILITIES

Although the Port of Port Arthur has a container handling capability, it does not have a dedicated intermodal railyard. The nearest intermodal railyards are in Houston. The PND report of the Port of Houston provides information on these facilities.

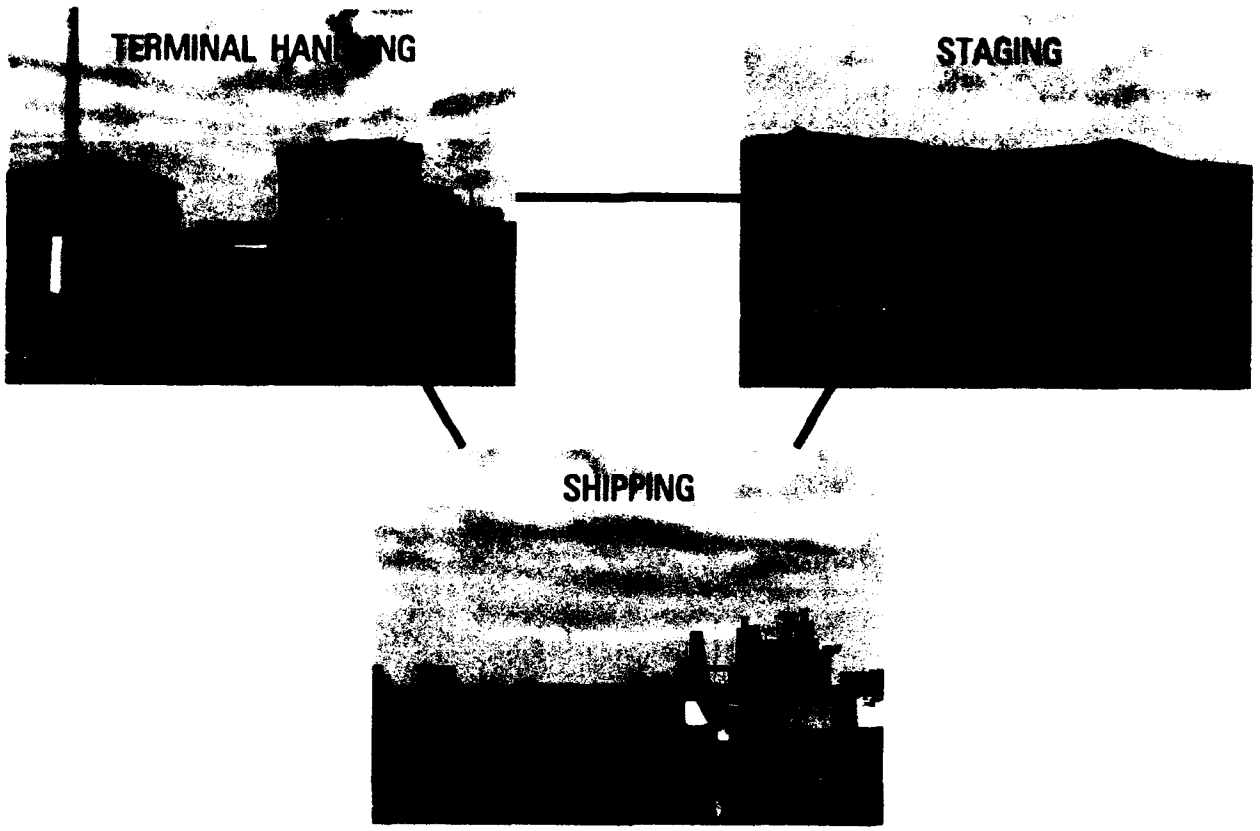
FUTURE DEVELOPMENT

The Port Authority of the Port of Port Arthur recently purchased 33 acres of cleared waterfront land directly southwest of berth 1. This area is the first marshaling area described in the marshaling area section. The plans are to develop this land into another 2,125 feet of wharf. This wharf will have a 100-foot apron and transit shed, similar to berths 1 and 2. When complete, the berths will be renumbered with berth 1 at the northeast end, and berth 5 at the southwest end. The current 75-ton crane will traverse the entire 3,325 feet of wharf. The Port Authority may install another crane if the need arises.

II. THROUGHPUT ANALYSIS

GENERAL

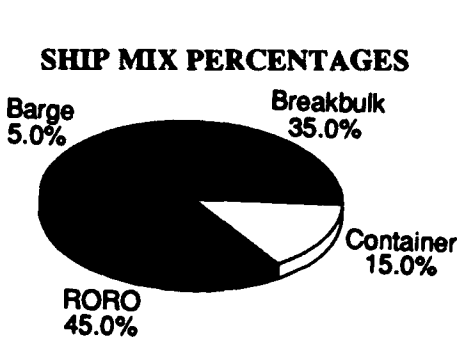
This section evaluates the theoretical throughput capability of the Port of Port Arthur using the port operational performance simulator (POPS) computer model. The model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/handling - in short tons (STON) and measurement tons (MTON) per day.



Terminal Throughput Subsystems

The analysis assumed that 80 percent of the port facilities will support the military deployment. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo dead-weights and expectations for future deployments.

SHIP MIX PERCENTAGES



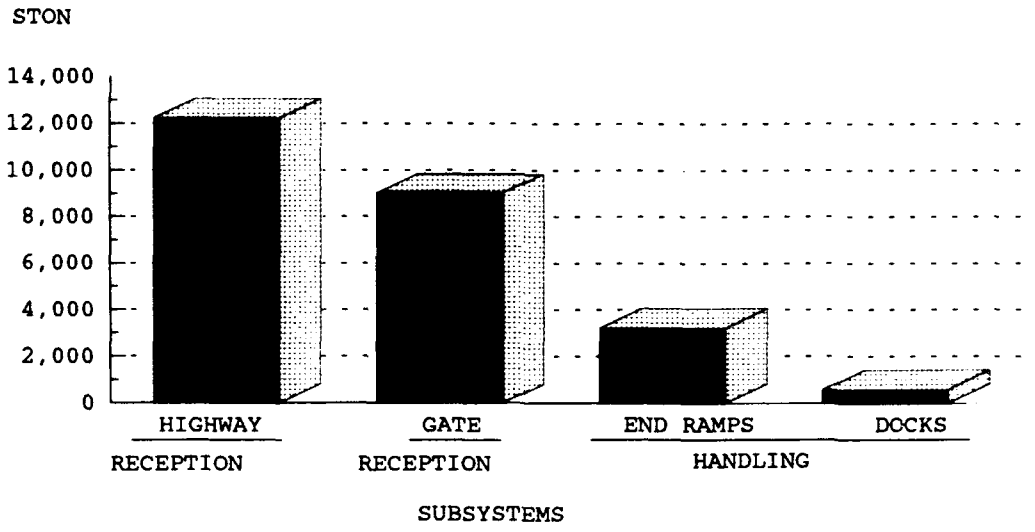
TERMINAL RECEPTION/HANDLING

HIGHWAY

The main routes to the port are via US Routes 69, 96, and 287 (from northwest) and Texas Routes 87 (from north or south), 73 (from west), and 82 (from east). The port has one main gate that allows access to the unloading and staging areas. The roadway in and out of the port, including the gate processing of vehicles, could handle more than 9,000 STON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to the staging area. Vehicles on commercial or military flatbed trailers not equipped with a means for unloading vehicles can offload at any of the truck docks by the transit shed. Supplies in van semitrailers can also offload at the truck docks. Using 55 of the available truck docks (with the other 50 truck docks serving as rail docks), these docks could offload nearly 3,800 STON (combined truck end-ramp and van handling capability) per day. Although the Port of Port Arthur is not specifically designed to handle containers, it has a limited container transfer capability.

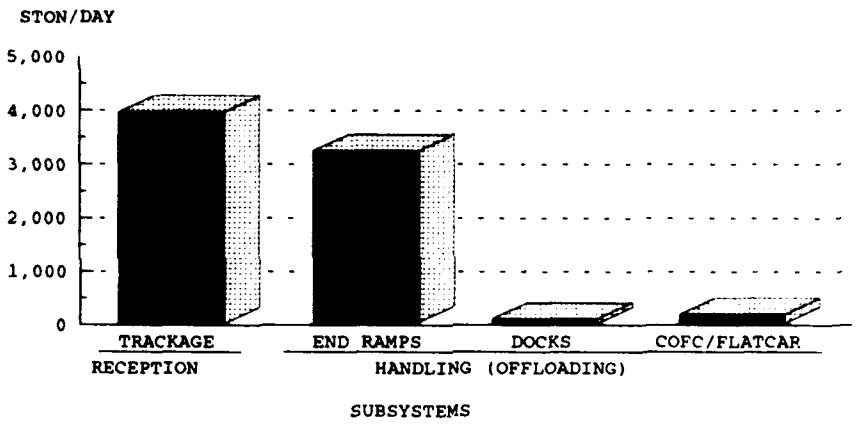
HIGHWAY RECEPTION/HANDLING CAPABILITY



RAIL

The Port of Port Arthur has three railroad tracks running along the wharf. These tracks allow direct transfer of cargo from railcar to ship. The port also has two tracks running along the inland side of the transit shed, which allow offloading of boxcars. The terminal office orders KCS to switch the tracks as necessary. The port has no permanent end ramps for circus-style loading. However, local stevedore companies can provide portable end ramps for offloading operations. A good location for these portable end ramps is the southwest end of the 140-railcar storage yard. Two rail spurs could be used to offload 60-foot railcars onto the cleared land downstream of the port (first marshaling area stated in the marshaling area paragraphs of section I). Each spur would support unloading about 14 railcars. This study uses a conservative assumption that the local stevedore companies will be able to provide only one end ramp.

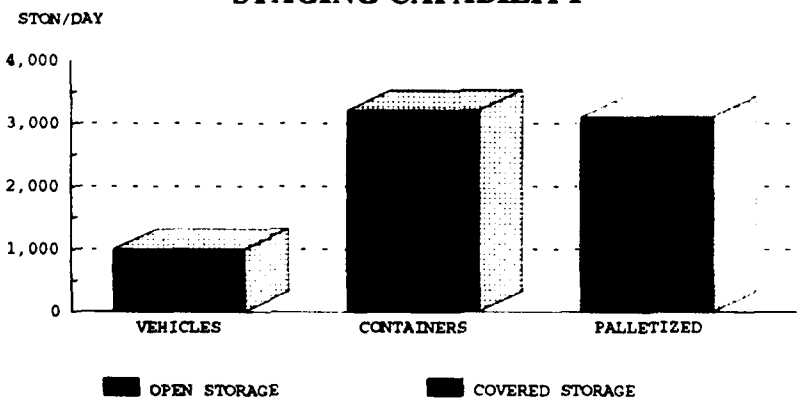
RAIL RECEPTION/HANDLING CAPABILITY



STAGING

The port has about 3 acres of open storage for vehicles and/or containers. Its staging area can store about 2,400 STON of breakbulk cargo and 950 STON of rolling stock (3,350 STON total) and 3,200 STON of containers. The port also has about 194,400 square feet of covered storage providing protection for about 3,100 STON of palletized cargo.

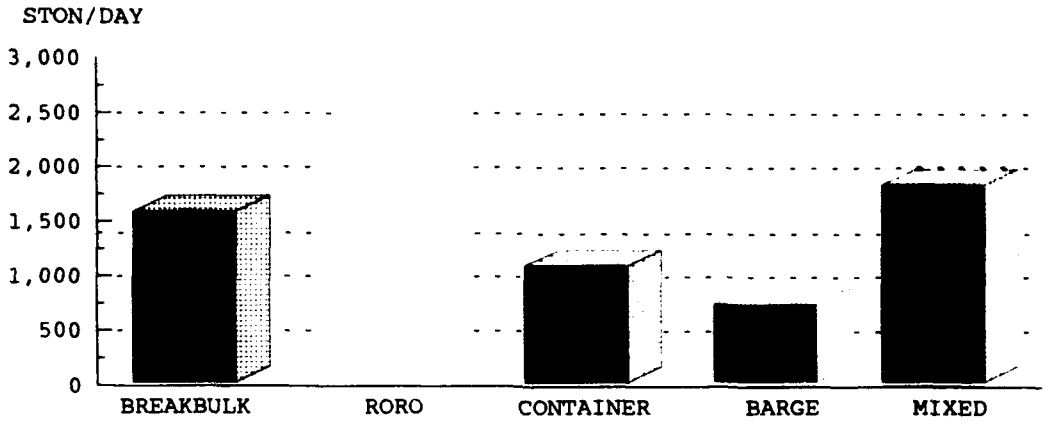
STAGING CAPABILITY



SHIPPING

The following chart shows the throughput capability per berth in STON per day for breakbulk, RORO, container, and mixed vessels. These results were based on various factors including MHE used, loading, operational, and berth usage rates, as well as berth/ship compatibility.

BERTH THROUPUT CAPABILITY



The berth/ship compatibility for various vessel types is shown in table 1. This table shows, for each type of ship, the number of vessels that berths 1 and 2 can accommodate. The table also provides the limitations that can hinder shipping operations.

TABLE 1

SUMMARY OF BERTHING CAPABILITIES OF PORT OF PORT ARTHUR

Breakbulk	
C3-S-33a	2
C3-S-37c	2
C3-S-37d	2
C3-S-38a	2
C4-S-1a	2
C4-S-1qb and 1u	2
C4-S-58a	2
C4-S-65a	2
C4-S-66a	2
C4-S-69b	1
Seatrain	
GA and PR-class	2
Barge	
LASH C8-S-81b	1
LASH C9-S-81d	1
LASH lighter	8
SEABEE C8—S-82a	1
SEABEE barge	6
RORO	
Comet	d,i,j
C7-S-95a/Maine-class	1
Ponce-class	h
Great Land-class	h
Cygnus/Pilot-class	1
Meteor	d,i,j
AmEagle/Condor	i,j
MV Ambassador	d
FSS-class	1,j,n
Cape D-class	i,j
Cape H-class	1,i
Container	
C6-S-1w	1,e
C7-S-68e	1,e
C8-S-85c	1,e
Combination	
C5-S-78a	1,e
C5-S-37e	1,e

a = maximum vessel draft limited to berth depth	h = no shore-based ramps available
b = inadequate apron width	i = insufficient ramp clearance at low tide
c = inadequate berth length	j = insufficient ramp clearance at high tide
d = no straight stern-ramp facilities	k = excessive ramp angle at low tide
e = no container-handling equipment	m = excessive ramp angle at high tide
f = inadequate berth depth, adequate anchorage depth	n = parallel ramp operation only
g = inadequate channel depth	o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

III. APPLICATION

GENERAL

In this section, we evaluate the port's throughput capability for deploying a notional mechanized infantry brigade using mainly FSS vessels. The *MARAD Planning Orders Digest* does not call for use of the Port of Port Arthur facilities during national emergencies. Therefore, we assumed that the deploying unit will have access to 80 percent of the port for deployment. We also assumed that the deploying unit will be able to deploy using both berths at the Port of Port Arthur.

REQUIREMENTS

The likely requirement for the Port of Port Arthur is to deploy a notional mechanized infantry brigade in 6 days. The brigade has to move about 2,600 vehicles and 220 containers. The movement of this brigade to the port will require 360 (60 per day) railcars using a convoy/rail option. Under this option, about 1,220 (205 per day) roadable vehicles would be driven, and about 775 (130 per day) would be towed.

MECHANIZED INFANTRY BRIGADE DEPLOYMENT DATA

Total Equipment

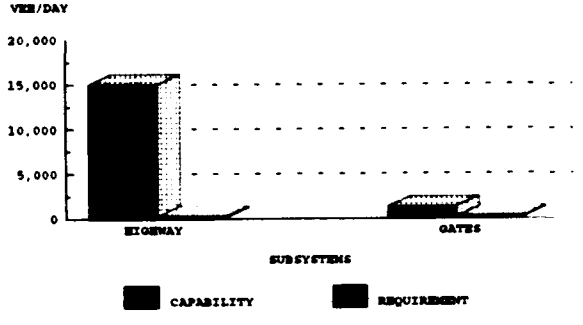
Volume	91,506 MTON
Weight	31,670 STON
Area	474,300 Sq Ft
Vehicles	2,600
Containers	220

TERMINAL HANDLING

HIGHWAY

Vehicles will access the Port of Port Arthur through the main gate from Lakeshore Drive West. Both the access road and gate can handle at least 1,200 vehicles per day.

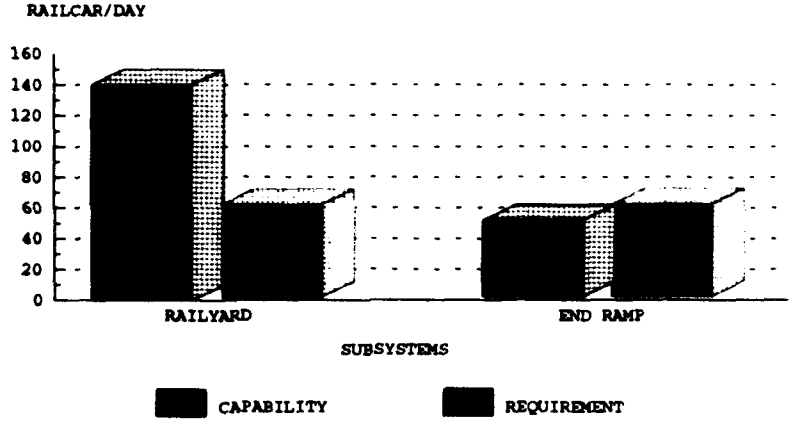
HIGHWAY INPROCESSING CAPABILITY



RAIL

The classification yard within the port could easily handle more than 140 railcars per day. However, the Port of Port Arthur does not have any rail end ramps. This study assumes that at least one end ramp will be available during deployment either through local stevedore companies or jury-rigging efforts of the deploying unit. If only one rail end ramp is available, the rail inprocessing/handling capability of the port may not meet the deployment requirement of the deploying unit. Our observation of the port shows that two rail spurs have potential for use during deployment. If local stevedore companies can supply 2 rail end ramps, then the capability to offload (100 railcars per day) will exceed the requirement.

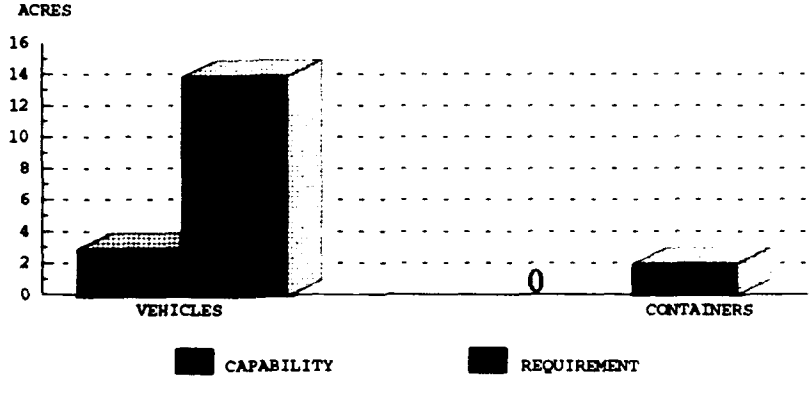
RAIL INPROCESSING/HANDLING CAPABILITY



STAGING

The port has about 3 acres of open storage area. We estimate that the Port of Port Arthur needs at least 16 acres (14 acres for vehicles and 2 acres for containers) of open staging to support the sustained loading of a one FSS vessel berth system.

OPEN STAGING CAPABILITY



SHIPPING

The number of ships needed to load this requirement depends on the shipping mix selected. The best ship mix would require three FSS vessels and one Cape H RORO ship. However, the turning basin is too small to accommodate an FSS vessel (see Section I, "General Data"). Also, the wharf length can accommodate only one vessel at a time. Based on 2 days to load a ship, a brigade cannot outload in 6 days on the required three FSS vessels and one RORO ship. Deploying units could outload using selected RORO and breakbulk vessels. However, a deploying mechanized brigade cannot likely outload within 6 days (see above table for number of breakbulk vessels needed to deploy a brigade).

UNIT MOVEMENT REQUIREMENTS
MECHANIZED BRIGADE

Minimum Containerization				
All FSS*	2.67	0.64		
FSS and Cape H	2.22	1.00		
All Breakbulk			12.57	
Maximum Containerization				
FSS and Container	2.64			0.67
FSS, Cape H, and Container	1.54	1.00		0.67
Breakbulk and Container			9.86	0.67

*Only eight FSS are available. Unit shipping requirements exceed the capacity of these eight vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

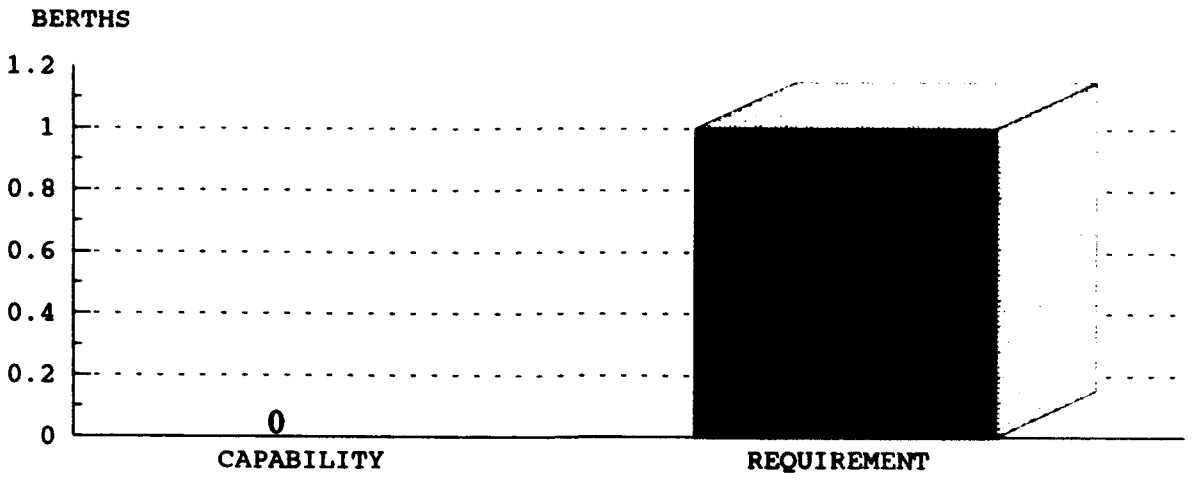
Legend:

RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, Aug 91.

FSS SHIPPING CAPABILITY



SUMMARY

The small turning basin north of the port limits the port to breakbulk and select RORO ships. Also, not enough berths are available to deploy a brigade in 6 days regardless of the type of ship used (FSS, RORO, or breakbulk) for deployment.

The Port of Port Arthur does not have enough staging area available to support deployment. The shipping subsystem is also a constraining factor in the throughput capability for the Port of Port Arthur.

The capability of the Port of Port Arthur to meet rail inprocessing/handling capability requirements depends on the ability to obtain two end ramps. End ramp use depends on availability from local stevedore companies or the fabrication ability of the deploying unit.

RECOMMENDATIONS

We do not recommend deploying a mechanized infantry brigade out of the Port of Port Arthur. However, deploying units could deploy portions of a brigade from the Port of Port Arthur using breakbulk or select RORO ships, if needed.

We recommend reevaluation of the Port of Port Arthur when the additional port facilities identified in the" Future Development" paragraph have been constructed and are ready for use.

APPENDIX

BERTH EVALUATION METHODOLOGY

GENERAL

This appendix provides a technique for accomplishing a comparative analysis of individual berths. The first step is to evaluate the individual berths within a port to determine their potential for breakbulk, RORO, container, and barge vessel operations.

INDIVIDUAL BERTH EVALUATION

For the individual berth evaluation, a comparison is made of the characteristics of each berth and the list of ideal factors required to support the different ship mixes. Tables 1 through 4 give the ideal factors for breakbulk, barge, RORO, and container ship mix operations. As the tables show, points are awarded for each factor. These are then used to compare the potential for each factor. These are then used to compare the potential of each berth to support the four ship mixes. A ranking of individual berths is established for each type of ship-mix operation, based on a comparison of the total points accumulated by each berth.

The berth receiving the highest accumulation of points is assigned a value of 1, and the remaining berths are ranked accordingly.

TABLE 1
IDEAL BREAKBULK BERTH FACTORS

Berth Type		*Transit Shed*	
Quay or marginal	10	Available 15	
Pier	7	None	0
Berth Length (ft)		*Deck Strength (lb per sq ft)*	
Greater than 750	20	Greater than 800	10
700 to 750	18	600 to 800	9
600 to 699	16	400 to 599	5
500 to 599	10	Less than 400	2
Less than 500			
Water Depth (ft) MLW		*Ship Service Facilities*	
Greater than 35.0	20	Power, water, and telephone	6
32.0 to 35.0	18	Power and water	5
30.0 to 31.9	16	Water only	4
28.0 to 29.9	14	None	0
Less than 28.0	12		
Apron Width (ft)		*Cranes*	
20.0 or greater	15	Wharf	10
Less than 20.0	5	Heavy-lift mobile (100 STON)	9
		Mobile	5
		None	0
Apron Tracks		*Conditional Age*	
2	10	New	10
1	7	10 years old	8
None	0	20 years old	4
		30 years or older	1

TABLE 2
IDEAL BARGE BERTH FACTORS

Berth Type		*Transit Shed*	
Quay or marginal	10	Available	10
Pier	7	None	5
Water Depth (ft) MLW		*Anchorages*	
Greater than 20.0	10	Protected	10
15.0 to 20.0	9	Partially protected	6
10.0 to 14.0	8	Unprotected	2
Less than 10	0	Unavailable	0
Apron Width (ft)		*Tug Availability of 650 hp or Greater*	
Greater than 60.0	10	More than 4	10
40.0 to 60.0	9	3 - 4	9
30.0 to 39.9	7	1 - 2	7
20.0 to 29.9	5	None	0
Less than 20.0	1		
Apron Tracks		*Barge Fleeting (No. of Barges)*	
2	10	40 or more	10
1	7	25	8
None	0	10	4
		None	0
Deck Strength (lb per sq ft)		*Conditional Age*	
Greater than 800	10	New	10
600 to 800	9	10 years old	8
400 to 599	5	20 years old	4
Less than 400	2	30 years or older	1
Cranes			
Wharf	10		
Heavy-lift mobile	9		
Mobile	7		
None	0		

TABLE 3
IDEAL RORO BERTH FACTORS

Berth Type		*Apron Tracks*	
Quay or marginal	10	2	10
Pier	5	1	7
		None	0
Berth Length (ft)		*Deck Strength (lb per sq ft)*	
Greater than 1,000	20	Greater than 800	10
900 to 1,000	18	600 to 800	9
800 to 899	16	400 to 599	5
700 to 799	10	Less than 400	2
600 to 699	6		
Less than 600	2		
Water Depth (ft) MLW		*Ship Service Facilities*	
Greater than 35.0	20	Power, water, and telephone	6
32.0 to 35.0	18	Power and water	5
30.0 to 31.9	16	Water only	4
28.0 to 29.9	14	None	0
Less than 28.0	12		
Apron Width (ft)		*Vehicle Access*	
Greater than 60.0	20	Uncongested	*10*
40.0 to 60.0	15	Congested	5
30.0 to 39.9	5		
Less than 30.0	0		
RORO Ramp Operations		*Conditional Age*	
Side, slewed, straight	10	New	10
Side, slewed stern	6	10 years old	8
Slewed stern	4	20 years old	4
Starboard, slewed stern	2	30 years or older	1
None	0		
Tidal Range (ft)			
0 to 3.9	10		
4.0 to 7.9	8		
8.0 to 11.9	6		
12.0 to 16.0	4		
Greater than 16.0	0		

TABLE 4
IDEAL CONTAINER BERTH FACTORS

Berth Type		*Deck Strength (lb per sq ft)*	
Quay or marginal	10	Greater than 1,000	10
Pier	5	800 to 999	8
		600 to 799	5
		400 to 599	3
		Less than 400	1
Berth Length (ft)		*Ship Service Facilities*	
Greater than 1,000	20	Power, water, and telephone	6
900 to 1,000	18	Power and water	5
800 to 899	16	Water only	4
700 to 799	10	None	0
600 to 699	6		
Less than 600			
Water Depth (ft) MLW		*Container Cranes*	
Greater than 40.0	20	Specialized container crane	20
35.0 to 40.0	18	Mobile gantry	16
32.0 to 34.9	16	Mobile crane (200-ton)	12
30.0 to 29.9	10	Mobile crane (100-ton)	8
Less than 28.0	6	None	0
Apron Width (ft)		*Container Handling Equipment*	
Greater than 60.0	10	Straddle cranes	10
40.0 to 60.0	9	Straddle trucks	9
30.0 to 39.9	5	Front/side-loading forklifts	8
20.0 to 29.9	2	Mobile cranes	5
Less than 20.0	1	None	0
Apron Tracks		*Conditional Age*	
2	10	New	10
1	7	10 years old	8
0	0	20 years old	4
		30 years or older	1
Consolidated Shed			
Available	10		
None	0		

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